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TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

VOL. 3.]

1915.

[No. 1.

BABESIASIS (PIROPLASMOSIS) AND THEILERIASIS.

- (1) SERGENT (Edm.), LHÉRITIER (A.) & BOQUET (A.). Études sur les Piroplasmoses en Algérie. (V^e note). Infection par les Piroplasmes de Bovins arrivant de France en Algérie, pendant l'Hiver. [Algerian Piroplasmoses. (Fifth note). The Infection of Cattle arriving in Algeria from France during the Winter.]—*Bull. Soc. Path. Exot.* 1914. Dec. Vol. 7. No. 10. pp. 699-700.

This short paper contains a tabular statement of the cases of piroplasmosis which have been observed in imported animals shortly after their arrival in Algeria.

The importation of cattle from Europe into Algeria is practically limited to milch cows. The table gives details of five cases, which were observed during December, 1911, and November, 1912.

The shortest period elapsing between arrival and the onset of the disease was 11 days, and the longest, 57.

The clinical features of the infection varied from case to case, and the parasites present were also variable in morphology ; bacilliform, ring-shaped, and pear-shaped parasites being observed.

- (2) SPREULL (J.). East Coast Fever Inoculation in the Transkeian Territories, South Africa.—*Jl. Comp. Path. & Therapeutics.* 1914. Dec. Vol. 27. No. 4. pp. 299-304.

Whereas in Natal success attended the efforts made to stamp out the disease, the measures that were adopted there were inapplicable in the Transkei. The short-interval dipping system has proved to be of the greatest value by destroying the ticks. In the Transkei, however, although the value of this method was realised by the authorities, it was impossible of adoption. The difficulties in the way of providing sufficient tanks, especially in view of the short time available, and the impossibility of educating the natives to realise the value of the method, compelled the adoption of other measures. The only alternative was to practise whatever method of inoculation promised any degree of success.

The first outbreak of the disease occurred at the end of March, 1910, and the author made an attempt to carry out protective inoculation in June of that year. The results were not satisfactory, but the author admits that worse have been obtained since.

The following year THEILER's method was adopted and by November a start had been made in inoculating animals in large numbers. Since that time considerably over a quarter of a million cattle have been treated.

The method adopted is the intravenous injection of a mixture of spleen and lymphatic gland obtained from an animal in an advanced stage of the disease. These materials are passed through a mincing machine.

Special precautions are necessary in carrying out the immunisation and these may be summarised as follows:—

- (1) The animals must be free from infection at the time of inoculation.
- (2) They should be on uninfected pasture, and should be kept there for 14 days after inoculation.
- (3) The vaccines must be prepared from materials derived from animals in an advanced stage of infection. Though such vaccines frequently cause loss they are preferable to weak vaccines, as these are apt to confer no immunity at all.
- (4) Special care must be exercised to prevent bacterial contamination, and vaccines must be used within six hours of preparation in winter and four hours in summer.
- (5) Thick vaccines are likely to cause thrombosis, and peptone is preferable to aleuronat for admixture with the vaccine.
- (6) Vaccines derived from several animals should be mixed so as to obtain uniformity.
- (7) Vaccinated animals must be placed on heavily infested land on the 15th day, and they must not be dipped.

The results depend upon the hold that the disease has on a herd. In clean herds the successes number about 70 per cent., in slightly infected herds from 50–60 per cent., and in moderately infected herds 30 per cent.

If clean cattle are inoculated when on infected veldt and kept there, the percentage of successes may be only 10 or 15. Where cattle are running on slightly infected veldt, it is recommended that they are dipped every five days for the first fortnight.

A single vaccine may give very varying results in a number of herds inoculated at the same time.

Abortion and lameness from thrombosis have been frequent accidents. Cattle should only be vaccinated at such seasons when highly infected veldt is available for a very thorough tick test afterwards.

The tick test should last for six to eight weeks according to the degree of infestation of the veldt. In winter a period of three months even does not yield such reliable results.

A second vaccination is considered advisable when a proper tick test has not been possible.

The conditions of the method indicate that it is one that cannot be practised in a civilised area except to cut short mortality rapidly in a badly infected district, and incidentally reduce the number of animals to such an extent that short-interval dipping could be adopted.

Cattle that have been inoculated and have passed through a satisfactory tick test, have maintained their immunity for three years and more.

Since the invasion of the Transkei by the disease, about 900,000 cattle have been lost, and the author believes that it will not be eradicated for some years to come, even under the most favourable circumstances.

- (3) i. CHALMERS (Albert J.) & ARCHIBALD (R. G.). *Babesia or Piroplasma*.—*Jl. Trop. Med. & Hyg.* 1914. Nov. 2. Vol. 17. No. 21. p. 323.
ii. LEIPER (R. T.). *Babesia or Piroplasma: A Reply to Chalmers and Archibald*.—*Ibid.* 1915. Jan. 1. Vol. 18, No. 1. p. 7.

The following are verbatim copies of the above communications:—
“i. While searching through botanical literature in the course of a certain joint work in connection with the *Fungi imperfecti* we chanced upon the following:—

“*Schizomycetaceae* Naegeli 1857.

“Genus *Babesia* Trevisan 1889.

“*Definition*.—Cocci ellipsoidei, longitudinaliter binatim seriati (diplococci longitudinales) in filamenta moniliformia, pseudodichotoma nuda concatenati. *Arthrosporae macrosomae* in apice filamentorum obvientes.

“*Etymology*.—Derived from the name of the celebrated Roumanian bacteriologist V. Babès.

“*Species*.—(1) *B. xanthopyreтика* Trevisan 1889, found in people suffering from yellow fever; (2) *B. erysipeloidis* Trevisan 1889, found in people suffering from erysipelas.

“It is obvious that as Trevisan applied the name *Babesia* in 1889 to a genus containing certain bacteria, this name cannot be used a few years later to name a genus of the protozoa and, therefore, the name *Babesia Starcovici* 1893 cannot be retained.

“This brings the nomenclature of the genus of protozoal organisms discovered by Babès down to the year 1895, when Patton introduced the word ‘Piroplasma’.

“The synonyms will therefore stand as follows:—

“Genus *Piroplasma* Patton 1895.

“*Synonyms*.—*Haematococcus* Babès 1888 (*nec Agardh*); *Pyrosoma* Smith and Kilbourne 1893 (*nec Péron*); *Babesia Starcovici* 1893 (*nec Trevisan*); *Amoebosporidium* Bonome 1895; *Ixodiplasma* Schmidt 1904.

“This, we hope, will end the confusion in that some authors use the name ‘Babesia’ and others ‘Piroplasma’ for the same genus of protozoal organism.”

“ii. In a recent issue of the *Journal of Tropical Medicine and Hygiene* attention is called by Chalmers and Archibald to the occurrence of the term Babesia in botanical literature and the statement is made: ‘It is obvious that, as Trevisan applied the name Babesia in 1889 to a genus containing certain bacteria, this name cannot be used a few years later to name a genus of the protozoa, and, therefore, the name *Babesia starcovici*, 1893, cannot be retained.’

“It appears to have escaped the authors’ recollection that the first of the International Rules of Zoological Nomenclature stipulates that: (1) Zoological Nomenclature is independent of Botanical.”

- (4) HINDLE (E.) & GÓZONY (L.). *Abderhalden’s Reaction and its Application in certain Protozoal Infections*.—*Parasitology*. 1914. Oct. Vol. 7. No. 3. pp. 228-239.

The introductory portion of this paper, which covers some four pages, outlines the nature of the reaction and explains its use, taking

as an example the diagnosis of pregnancy. Then follows a detailed account of the technique employed, special attention being directed to the controls that are essential.

In view of the fact that Gózony has obtained some very favourable results with the method in connection with spirochaetosis, trypanosomiasis and sarcosporidiosis, the authors have made some observations with intra-corpuscular parasites—namely, *Theileria parva* and *Babesia canis*.

Theileria parva.—Exp. 1.—A calf was infected by having placed upon it infected nymphs of *R. appendiculatus*. Parasites appeared in the blood on the 17th day. On the 20th day, when 13 per cent. of the corpuscles were invaded, a quantity of serum was obtained from the animal and tested against organs of a normal calf. As a control, a parallel set of tests were made with normal calf serum.

The following table gives the results obtained :—

Organ employed.	+ 1·5 cc. infected serum.	+ 1·5 cc. normal serum.
Brain	+	—
Kidney	—	—
Liver	+	—
Lymphatic gland	+	—
Lung	+	—
Pancreas	+	—
Spleen	+	—
Suprarenal gland	+	—
Thyroid	+	—
Thymus	+	—
Control (serum alone)	—	—
Control	—	—

The calf was killed when moribund on the 26th day. At the time of death about 40 per cent. of the corpuscles contained parasites, and at the post-mortem "all the organs were found to contain infarcts with *Theileria* present."

Pieces of the organs were prepared in the usual manner and were tested against the calf's own serum both active and inactivated.

The results were as follows :—

Organ employed.	+ 1·5 cc. infected serum.	+ inactive infected serum.
Infected Brain	+	—
" Diaphragm	+	—
" Heart muscle..	+	—
" Lymphatic gland	+	—
" Lung	—	—
" Muscle	+	—
" Pancreas	+	—
" Spleen	+	—
" Suprarenal gland	+	—
" Thymus	+	—
" Thyroid	+	—
Control (serum alone)	—	—
"	—	—

An experiment was also made with the parasites themselves. The red corpuscles from a litre of the animal's blood were cytolysed by digitoxin, the parasites being separated by centrifugation. These

were then washed and mixed with egg albumin, which was then boiled. The resulting coagulum was tested and a strongly positive reaction was obtained. Agglutination and complement fixation tests with the parasites gave negative results.

In a second experiment carried out on the same lines three sets of tests were made. The first when the temperature rose, the second six days later—i.e., the day after parasites appeared in the circulation—and eight days later, when 30 per cent. of the corpuscles were invaded.

In each of these sets of tests active and inactivated serum was used against some of the tissues. The results were as follows:—All the tests carried out with inactivated serum were negative, as were those with active serum taken on the rise of temperature. Three out of 14—viz., tests against lymphatic gland, suprarenal gland, and isolated parasites—were positive with serum taken the day after the appearance of parasites, and nine out of 12 were positive with the third sample of serum.

In the case of *Babesia canis* less satisfactory results were obtained owing to the destruction of the red corpuscles with the resulting liberation of haemoglobin. Satisfactory results were only obtainable with blood taken during the early stages.

In the first experiment one positive result out of six tests was obtained with the serum and liver of a dog inoculated 10 days previously and destroyed three days after the appearance of parasites in the blood.

In a second experiment positive results were obtained with liver, brain, pancreas, heart, and lung, but in this case the serum used contained some haemoglobin.

TRYPANOSOMIASIS.

- (5) BRUCE (D.), HAMERTON (A. E.), WATSON (D. P.), & Lady BRUCE. Trypanosome Diseases of Domestic Animals in Nyasaland. *Trypanosoma caprae* (Kleine). Part III. Development in *Glossina morsitans*.—*Proc. Roy. Soc.* 1914. Aug. 27. Series B. Vol. 88. No. B 601. pp. 92–96. With one coloured plate.

An abstract of the previous paper regarding the morphology and pathogenicity of this trypanosome is given in this *Bulletin*, Vol. 1, page 206.

T. caprae belongs to the *T. vivax* group, which comprises trypanosomes the development of which is restricted to the proboscis of the transmitting fly.

Six experiments were carried out with laboratory-bred flies. In three instances the experiments were made at the ordinary laboratory temperature during the winter, and in the others at incubator temperature of 84° F. Of the first group two experiments were successful and the third failed, and of 34 flies used in the positive experiments only two were found to be infected. It is said that the low percentage of infected flies was no doubt explained by the

temperature, and also by the fact that sheep and goats infected with *T. caprae* are unsatisfactory for the feeding of flies, as trypanosomes are variable in their appearance in the blood and are never numerous.

In the experiments carried out at incubator temperature the percentage of infected flies found ranged from 30 to 40.

No attempt was made to study the flagellate in the fly in the early stages as sufficient flies were not available, but a number of illustrations in colour are given of the parasites as found from the 19th to the 30th day, and also of the final stage of development.

Conclusions :—

“ 1. *Trypanosoma caprae* is capable of passing through a cycle of development in *G. morsitans*, the flies becoming infective some 19 days after feeding on an infected animal.

“ 2. *Trypanosoma caprae* belongs to the same group as *T. vivax* and *T. uniforme*, the development taking place only in the proboscis.

“ 3. The final stage of the development takes place in the hypopharynx where the trypanosomes revert to the original “ blood form ” and become infective.”

- (6) BRUCE (D.), HAMERTON (A. E.), WATSON (D. P.), & Lady BRUCE.
The Trypanosome causing Disease in Man in Nyasaland. The Naturally Infected Dog Strain. Part I.—Morphology.—*Proc. Roy. Soc.* 1914. August 27. Series B. Vol. 88. No. B 601. pp. 111–130.
With 3 plates and 8 charts.

The authors state that this strain differs in so marked a way from the human, fly, and game strains, that had it been found in wild game or in *G. morsitans* it would have been legitimate to make a new species of it. As, however, it was only met with in the chronically diseased dogs, the making of a new species would not be justified. The dogs were obtained in the proclaimed area, but not all infected dogs from the area showed this strain.

Attention is drawn to the fact that this strain is of very low pathogenic power for the monkey and guinea-pig, and also to the small proportion of blunt-ended posterior-nuclear forms.

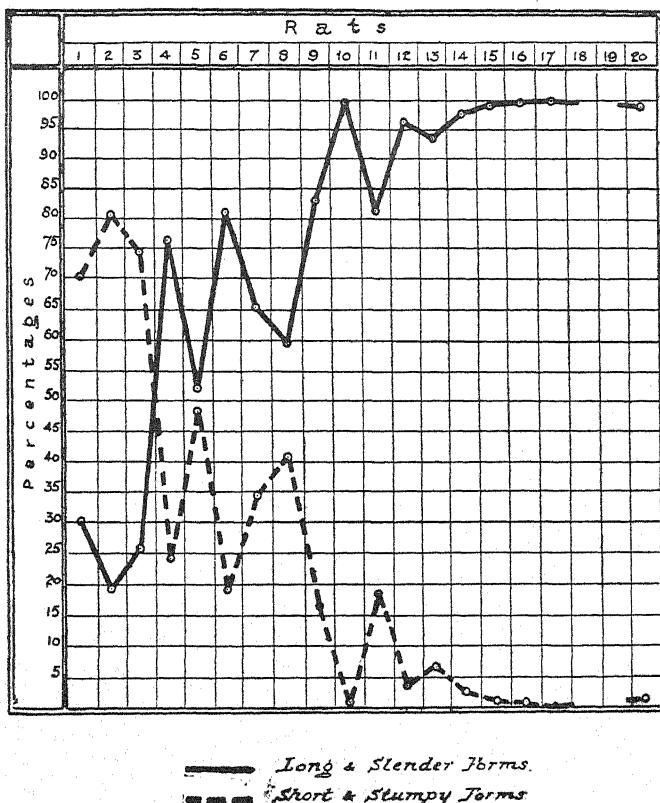
Large numbers of measurements were made of the parasite immediately after it was obtained, at an interval of seven months, and also of two years, it having been maintained in rats during these periods. In the biometric curve constructed on the first set of measurements, it was seen that while the curve indicated dimorphism there was a marked preponderance of short forms. The curve constructed on measurements after passage through eight rats (seven months) was still dimorphic, but the two peaks were almost at the same level. The curve based on the measurements taken after two years in rats was almost of the monomorphic type, the stumpy forms had almost disappeared, and the percentage of long parasites had very greatly increased.

That this was not in the nature of an accident is shown by a chart representing the gradual change of type through an unbroken series of 20 rats. In this chart, which is reproduced*, the unbroken line represents the long slender forms, and the broken line the short stumpy forms.

* From the *Proceedings of the Royal Society*.

The second of these naturally infected dog strains was found to be very markedly dimorphic, the form of the chart almost suggesting that two trypanosomes might be present.

The third strain was practically monomorphic, the majority of the parasites ranging from 26 to 32 microns in length.



"This seems to shew how fallacious it is to reason from laboratory types of trypanosomes to the wild types, and probably accounts for the showers of new species which are constantly falling about our ears."

In view of the possibility of there being in reality two parasites present in these infections, the third strain representing a survival of the slender parasite, an attempt was made to cause Strain 1 to revert to the original dimorphic form.

When this strain, after two years in the rat, was again inoculated into a dog, a reversion to the dimorphic form was produced. In the blood of the rat after two years' passage through rats the peak of the chart of 500 trypanosomes occurred at 29 microns, but when this strain was again passed into a dog the peak of the chart occurred at 21 microns, there being also a small rounded elevation in the curve at 25 to 28 microns. Nearly one-fifth of the parasites were now of the short stumpy type.

From these facts it would appear that passage through the rats favours the production of the long slender parasites, while passage through the dog at once causes a return to the dimorphic type.

No explanation of the origin of these strains in the dog was forthcoming, and an attempt to test the theory that long sojourn in the blood of a dog was responsible for the changes did not furnish any evidence of this being the case.

Conclusions :—

" 1. The Naturally Infected Dog strain differs slightly from the other strains of the trypanosome causing disease in man in Nyasaland, in that there are fewer of the posterior-nucleated, blunt-ended forms which are sometimes so much in evidence in the ordinary strains.

" 2. Taking into consideration the fact that this strain was only found in three chronically infected dogs, it is concluded that it is an aberrant strain of the widely spread species *T. brucei vel rhodesiense*, the trypanosome causing disease in man in Nyasaland."

Part II. Susceptibility of Animals.—*Ibidem.* pp. 130–138.

The bulk of the experiments regarding the pathogenicity of these strains of trypanosomes were carried out with that called No. 1 strain, as the other two were accidentally lost.

In a tabular statement are given details of the inoculation of a large number of animals including cattle, goats, sheep, antelope, monkeys, dogs, rabbits, guinea-pigs, and rats.

The following is a summary of the results obtained :—

Four cattle were inoculated, but in one only did the infection succeed. In this animal the parasites were present in small numbers on three occasions only, and the animal recovered. Six out of 21 goats inoculated shewed trypanosomes in their blood on a few occasions and in small numbers. Four recovered and one died, but no post-mortem examination was made to ascertain whether the infection was responsible for death.

Two sheep were inoculated successfully, and one died, probably of the disease, after 64 days.

Six out of 27 monkeys were infected, but all recovered. The strain became virulent for dogs after several passages.

In four the inoculation failed to infect, and five recovered. The remainder died in from 11 to 102 days. The lesions were those of nagana.

Two rabbits were successfully inoculated, and both shewed the lesions of nagana in a rather mild form.

Two guinea-pigs out of 21 became infected, but recovered.

The strain was invariably fatal for the rat, death taking place in from 7 to 94 days (average 30·8).

The authors consider that for the present the parasite should be included among the strains of *T. brucei vel rhodesiense*, but that if it should be decided to make it a separate species the name *T. anceps* would be a suitable one. Conclusions :—

" 1. The Naturally Infected Dog strain is fatal to dogs, rabbits, and white rats, but oxen, goats, monkeys, and guinea-pigs appear to be refractory.

" 2. The Commission is of opinion that this is an aberrant or exceptional variety or strain of the trypanosome causing disease in man in Nyasaland—*T. brucei vel rhodesiense*."

Part III. Development in *Glossina morsitans*.—*Ibidem.* Sept. 15.
No. B 602. pp. 213-218.

Eleven experiments were carried out and of these two gave positive results. In the first of them, flies were fed on an infected rat for five days, and then in succession on a dog, monkey, guinea-pig, duiker, and a second monkey. The period during which the flies were fed upon these animals ranged from 3 to 25 days, and they were starved for one day between successive feeds. Of this group only the guinea-pig failed to become infected.

In the second successful experiment the flies were fed upon an infected rat for six days and then after one day's starvation upon a healthy dog for 58 days. The number of days elapsing before the flies became infective were 24 and 58 days respectively. In both cases the flies were kept at 84° F, and all were laboratory bred.

Thirty flies were used in the first of the successful experiments, and when these were dissected three were found to be infected.

In one of these trypanosomes were found in the proventriculus, and in all three the fore- and mid-guts were invaded. In one the hind-gut shewed trypanosomes, and in one there were trypanosomes in the salivary glands.

It appears to be probable that the one fly having an infection of the salivary glands was responsible for all the infections.

In the negative experiments 185 flies were dissected and 11 were found to be infected. None of these, however, had any trypanosomes in either the proboscis or the salivary glands. With regard to the morphology of the trypanosomes in the flies, those present in the intestine were exactly like those of the human strain in the same situation, and the salivary glands of the single fly showing invasion of these organs contained exceedingly numerous small active trypanosomes which when stained were seen to be typical blood forms. Conclusion:

"The trypanosome of the Naturally Infected Dog strain belongs to the same group as *T. gambiense* and *T. brucei vel rhodesiense*, the trypanosome causing disease in man in Nyasaland, and is probably merely a weak strain of the latter species."

Part IV. Experiments on Immunity.—*Ibidem.* pp. 219-226.

This paper contains in tabular form the details of a number of experiments carried out with the object of ascertaining whether the "Naturally infected dog strain" would protect against the "Human," "Wild Game," "Wild *Glossina morsitans*," and "Zululand 1913" strains.

Complete cross tests were not possible as it is only exceptionally that an animal recovers from the human or other strains. The results of the experiments are set out in the conclusions.

Conclusions:—

"1. The Naturally Infected Dog strain does not protect animals from the Human, Wild *G. morsitans*, and Zululand, 1913, strains.

"2. The Wild *G. morsitans* strain and the Naturally Infected Dog strain do not protect animals from the Human or the Zululand, 1913, strain.

"3. The Wild *G. morsitans* strain does not protect against the Human strain.

"4. In spite of the damaging evidence of these experiments, the Commission still holds the opinion that the Naturally Infected Dog strain is a weak strain of the trypanosome causing disease in man in Nyasaland, *T. brucei vel rhodesiense*."

- (7) GALLAGHER (G. H.). The Transmission of *Trypanosoma brucei* of Nigeria by *Glossina tachinoides*, with Some Notes on *Trypanosoma nigeriense*.—*Jl. Trop. Med. & Hyg.* 1914. Dec. 15. Vol. 17. No. 24. pp. 372-375.

The author records the occurrence of *G. tachinoides*, *G. palpalis*, and *G. caliginea* in the Eket district where he was in charge of the sleeping sickness camp.

T. brucei.—The trypanosome to which the author refers under this name is a polymorphic parasite shewing posterior nuclear forms. The strain was obtained by feeding 128 *G. tachinoides* upon a guinea-pig.

In the living state the parasite is freely motile, but not much change of position is observed. In stained preparations it is seen to possess the classical polymorphic morphology.

In inoculated animals the long forms predominated at first and then the stumpy and intermediate forms increased, and in cases where the infection was relatively chronic these become dominant.

There was no definite relationship regarding the number of posterior nuclear forms present.

The parasite varied from 12 to 32 microns in length.

In rats, in which the strain was kept after having been passed through two guinea-pigs, the average length of life was 35 days, with a minimum of 14 and a maximum of 59. The period of incubation ranged from 6 to 13 days.

T. nigeriense.—This was obtained by the inoculation of a guinea-pig and a monkey with cerebro-spinal liquid from a case of sleeping sickness which terminated fatally a few hours later.

Parasites were never numerous in the blood of these animals.

Three guinea-pigs and a mouse inoculated respectively from the original guinea-pig and monkey had not shewn evidence of infection at the time of writing.

The short stumpy forms described by MACFIE, upon which the claim for specific identity are based, have been found in the original animals which were still surviving at the time of writing, and according to competent observers they were relatively more abundant than in any strains of *T. gambiense*. A claim is therefore made for the retention of the name *T. nigeriense*.

- (8) BRUCE (D.), HAMERTON (A. E.), WATSON (D. P.), & Lady BRUCE. Morphology of Various Strains of the Trypanosome causing Disease in Man in Nyasaland : The Human Strain (continued).—VI to X.—*Proc. Roy. Soc. Sept. 15. 1914. Series B. Vol. 88. No. B 602.* pp. 190-205.

The authors have already published an account of the morphology of five strains of human trypanosomes (see this *Bulletin*, Vol. 1, p. 205), and in the present communication a further set of five is dealt with.

In three instances the trypanosomes were inoculated direct from the infected natives into rats, and in the remaining two instances the strains were passed through a single monkey before the rat was inoculated. The measurements were made in each case from preparations of the rat's blood.

Tables are given showing the maximum, average and minimum length of 500 trypanosomes of each strain, the distribution in respect

of length, the percentage of posterior-nuclear forms, and the average, the maximum, and the minimum breadth of the trypanosomes. A curve based upon the measurements obtained is also given in each case.

From the figures given the following details may be gathered: The average length of the five strains of trypanosomes ranged from 21·2 to 23·5 microns, the maximum length from 32 to 34, and the minimum length from 14 to 17 microns.

The figures showing the percentages of posterior nuclear forms indicate a considerable variation in this respect, ranging from 5·0 to 28·6.

With regard to the breadth of the trypanosomes belonging to the different strains there was very little variation, the average ranging from 2·56 to 2·71, the maximum from 4·5 to 5·0, and the minimum being in every case 1·25 microns.

Six experiments were made to show by means of inoculation with a single trypanosome that a single species was being dealt with. In three instances a positive result was obtained, a rat inoculated with a single long slender trypanosome developing in its blood all the forms found under natural conditions.

The following conclusion is drawn:—

"These five further strains of this trypanosome, isolated from five natives in Nyasaland, belong to the same species, *Trypanosoma brucei vel rhodesiense*, the trypanosome causing disease in man in Nyasaland."

- (9) BRUCE (D.), HAMERTON (A. E.), WATSON (D. P.), & Lady BRUCE. The Trypanosome causing Disease in Man in Nyasaland: The Liwonde Strain. Part I—Morphology. Part II.—Susceptibility of Animals.—*Proc. Roy. Soc.* 1914. August 27. Series B. Vol. 88. No. B 601. pp. 97-111, with 5 charts.

The strain described in this paper was obtained in the Upper Shire Valley about 100 miles south of the "Proclaimed Area," at a place where no cases of disease in man had been observed up to that time. Subsequently a case was discovered at Mpimbi, about 50 miles further south. The strain was taken to Kasu in dogs, and subsequently passed into rats and other animals, but for the purposes of studying the morphology of the parasite only trypanosomes from rats were used.

The parasites were measured in the manner adopted by Bruce, and charts based upon the measurements and distribution of the parasites according to their size were constructed. Tabulated statements also show the effects of the three strains when injected into animals of different species.

The following conclusions are drawn:—

"1. The three wild *G. morsitans* strains from the Liwonde district resemble each other closely, and all belong to the same species of trypanosome.

"2. The Liwonde strain belongs to the same species as that occurring in man, wild game, and wild *G. morsitans* inhabiting the 'Proclaimed Area,' Nyasaland—*T. brucei vel rhodesiense*.

"3. Hence it would appear that wild *G. morsitans* occurring in a district 100 miles south of the 'Proclaimed Area' are infected with the trypanosome which causes the human trypanosome disease of Nyasaland."

- (10) BRUCE (D.), HAMERTON (A. E.), WATSON (D. P.), & Lady BRUCE. The Trypanosome causing Disease in Man in Nyasaland. II. The Wild-game Strain. III. The Wild *Glossina morsitans* Strain. Part II.—Susceptibility of Animals.—*Proc. Roy. Soc.* Sept. 15. 1914. Series B. Vol. 88. No. B 602. pp. 205–212.

The previous papers dealing with the morphology of these two strains are abstracted in this *Bulletin*, Vol. 1, pp. 270 and 271.

In the present communication the effects of the strains upon animals are set out in tabular form and comparisons are instituted between them and also between them and the human strain.

The results obtained are collected into the following table:—

The average duration in days of the wild-game, wild *Glossina morsitans*, and human strain of the trypanosome causing disease in man in Nyasaland, in regard to their virulence towards various animals.—

Strain.	Ox.	Goat.	Monkey	Dog.	Rabbit.	Guinea-pig.	White rat.
Human	134	42	26	34	28	67	30
Wild game ..	—	46	38	41	—	—	32
Wild <i>G. morsitans</i>	Rec.	54	38	29	47	81	26

A further table compares the percentages of recoveries in the different species inoculated with the three strains. In the case of the human strain 80 per cent. of the cattle inoculated recovered, but there were no recoveries among the other species of animals inoculated. There were no recoveries from inoculations with the wild-game strain. With the wild *G. morsitans* strain, all the cattle, six per cent. of the goats, seven per cent. of the monkeys, and four per cent. of the dogs, recovered.

The conclusions are as follows:—

“ 1. The pathogenic action on various animals of the Human strain, the Wild-game strain, and the Wild *G. morsitans* strain is so much alike, that it may be concluded that they all three belong to the same species of trypanosome.

“ 2. This species in *T. brucei* vel *rhodesiense*, the trypanosome causing disease in man in Nyasaland.”

- (11) MACFIE (J. W. Scott) & GALLAGHER (G. H.). Sleeping Sickness in the Eket District of Nigeria.—*Ann. Trop. Med. & Parasit.* 1914. Dec. 15. Vol. 8. No. 3. pp. 379–438. With 5 plates, one text-figure, one map, and two appendices.

The existence of the disease was first suspected in 1906, and the first case diagnosed by the discovery of the trypanosomes was in 1912.

Clinically the disease is much milder than that occurring in the Congo and Uganda. A brief description of the physical and meteorological conditions of the district is given and it is mentioned that sheep, goats, and dogs are commonly met with, and that a few dwarf cattle are also found. Larger cattle and horses are unknown. The density

of the population (about 250 per square mile) explains the almost complete absence of game. Small antelope and occasionally elephants may be found, and in some places monkeys are common.

Biting flies are fairly numerous. Tabanidae are abundant on the Qua Iboe River and *Chrysops dimidiata* has been found in a number of places. Tsetse flies have a wide distribution but occur in small numbers only.

The centre of the sleeping sickness area is at Ikotobo, and the commonest species of tsetse fly there is *G. tachinoides*. It is pointed out that this species is especially easy to get where there are pigs. The pig, however, is considered an unclean animal, possibly on account of the association with flies, and is forbidden by the native law, but the law is evaded.

Diagnosis was difficult because clinically the disease was very mild, and because trypanosomes were very difficult to detect.

Microscopic examination of thin and thick blood smears, and of smears of gland juice obtained either by puncture or by incision was resorted to. Experimental inoculation was practically impossible as experimental animals were difficult to obtain (monkeys were unobtainable), and also the trypanosome has a low degree of virulence and sometimes fails to infect guinea-pigs.

In no case were trypanosomes found in the peripheral blood, and in a large number of cases examination of gland juice also proved negative.

The symptoms of the disease are summarised.

In view of the difficulty of discovering the trypanosome and of the fact that spontaneous recovery appears to occur, it is difficult to gauge the value of treatment, but a weekly intramuscular injection of 6 grs. of atoxyl appears to be well tolerated. The presence of intercurrent diseases such as malaria also complicates matters.

The trypanosome is of very low virulence for experimental animals. The white rat appears to be refractory and only a proportion of guinea-pigs inoculated with materials containing trypanosomes become infected (one out of seven). Five cubic centimetres of blood from a proved case of the disease failed to infect a guinea-pig. In the single positive guinea-pig, trypanosomes were first seen on the 27th day, and they remained very scanty for about a week, but they then increased slightly in numbers although they were still rare. The presence of short thick parasites which the authors believe to be characteristic of the strain was detected.

In view of the scantiness of trypanosomes in the enlarged glands and their absence from the peripheral blood, a difficulty arises to explain the infection of the fly. It is suggested that the human infection must depend upon a cycle of development including an insect and another animal host which has not yet been identified, the trypanosome losing virulence in the human host. In this connection attention is drawn to BRUCE's observation that *T. simiae* lost its virulence for the monkey after passage through the goat.

G. tachinoides was found to harbour *T. pecaudi* (*T. brucei* Uganda), *T. vivax*, and *T. pecorum*, and possibly also *T. nigeriense*, but the insusceptibility of experimental animals to this trypanosome prevented any actual evidence of this being obtained.

The authors were unable to obtain any wild animals for examination as game is very scanty, but in sixteen domestic animals, viz., four sheep, four goats, two dwarf cattle, four dogs, and two pigs *T. nigeriense* was not found. The dwarf cattle were found to harbour a parasite resembling *Theileria parva*, but no symptoms of illness were observed.

Appendix I by EAKIN (W. C. W.) contains a summary of the views held by the natives regarding the disease.

In the second appendix, by Macfie, are given the details of six experiments in which wild *G. tachinoides* were fed upon healthy animals with the object of discovering what species of trypanosomes may be transmitted by this fly. The results showed that *T. pecaudi* (*T. ugandae*), *T. pecorum* (*T. congolense*), and *T. vivax* are transmitted by *G. tachinoides*.

- (12) OGAWA. *Étude Morphologique et Biologique sur Trypanosoma pecaudi.* [Morphological and Biological Studies of *Trypanosoma pecaudi.*]—*Ann. Inst. Past.* 1914. July. Vol. 28. No. 7. pp. 677-691. With 7 curves and 1 text-fig.

The strain used in these investigations was one brought from Dahomey in 1908 and since maintained in guinea-pigs.

In guinea-pigs the course of the disease varied from eight to 20 days, with an average of 16. The period of incubation was two to six days. In the mouse the disease runs a more rapid course, death occurring on an average on the sixth day.

In guinea-pigs a crisis occurred which lasted from one to three days, during which period trypanosomes were not discoverable in the blood. No crises occurred in the mice.

Long slender forms and short stumpy ones were observed in all the experimental animals.

In the fresh state the parasite is very actively motile, the motility often involving considerable translation. In stained films posterior nuclear forms have been observed, and in one instance the nucleus was posterior to the blepharoplast.

The long slender parasites first appeared in the blood, and were followed by the short stumpy forms. The latter steadily increased in number for a time, and then the long forms again appeared to predominate just before death.

Numerous tables and charts are given showing the measurements of the trypanosomes and their proportional distribution, and attention is drawn to the great variability of form of curves obtained.

Serum obtained from infected guinea-pigs during crises was found to have a protective action, in that it prolonged the period of incubation when mixed with infective blood and allowed to remain in contact with it for a variable length of time before the mixture was injected into a test animal.

Attempts to cultivate the trypanosome failed, although they retained their vitality in some cases for several days in the culture media. These persistent trypanosomes were, however, found to be avirulent.

- (13) LAVERAN (A.) & ROUDSKY (D.). De l'Inoculabilité du *Trypanosoma lewisi* au Loir (*Myoxus glis*). [The Inoculability of *T. lewisi* for the Dormouse *Myoxus glis*.]—*Bull. Soc. Path. Exot.* 1914. Nov. Vol. 7. No. 8-9. pp. 654-657.

In a previous communication (see this *Bulletin*, Vol. 2, p. 131) the authors published their observations regarding the infection of a number of species with *T. lewisi* and *T. duttoni*, and they drew special attention to the facts that the infections produced were always of short duration and that they could not be transmitted in series of any species.

The authors have had the opportunity of carrying out a series of similar experiments with a number of loirs* received from Italy. They are only very rarely found in France.

In the course of their experiments they found that the loir is refractory to *T. duttoni*, but susceptible to *T. lewisi*. They further found that *T. lewisi* could be transmitted in series in the loir. The course of the infections did not exceed four or five days, but trypanosomes were sometimes present in the blood in considerable numbers.

Recovery from the infection left the animals with a degree of immunity which enabled them to resist re-infection for a period of six weeks. Lack of animals prevented further experiments.

Attention is drawn to the fact that the lerot, which is closely allied to the loir, is far less susceptible to *T. lewisi*, and, as already stated, the loir was found to be resistant to *T. duttoni*, which is so closely allied to *T. lewisi*.

- (14) LAVERAN (A.). L'Immunité que confère souvent aux Caprins une Première Atteinte de Trypanosomiase peut-elle être transmise héréditairement? [The Possible Hereditary Transmission of the Immunity sometimes conferred upon Goats by an Attack of Trypanosomiasis.]—*Bull. Soc. Path. Exot.* 1914. Dec. Vol. 7. No. 10. pp. 724-730.

The experiments detailed in this paper were carried out with the object of ascertaining whether, in countries where trypanosomiasis occurs, an advantage would attach to the use of animals that had acquired immunity.

During the last two years a number of observations have been made on the kids of goats which the author has used in some of his experiments regarding trypanosomiasis. Full details of these six experiments are given in the paper, and are summarised as follows:—

(1) A goat which had recovered from a severe infection with surra, and which was immune against the disease, gave birth to a kid which died shortly after birth. Blood collected from the heart of the kid immediately after death yielded a serum which was quite inactive when mixed with the virus of surra.

(2) A goat which had acquired immunity against surra gave birth to a kid which was inoculated with *T. evansi* 26 days later. The kid

* The loir is the large European dormouse (*Myoxus glis*); the lerot is smaller and belongs to Southern Europe and Northern Africa (*Eliomys*; several species).

became infected. At an interval of 71 days after inoculation, the animal died with suppurative arthritis, which did not appear to have any connection with the trypanosomiasis.

(3) A goat which was immune to surra and debab gave birth to two kids. One of these was inoculated a month after birth with the virus of debab. It became infected, and the disease ran a normal course. The other, which was inoculated with the virus of surra six weeks after birth, also became infected, the disease following a normal course.

(4) A goat which had recovered from infection with *T. gambiense* gave birth to two kids. One of these was bled a month after birth and the serum obtained when mixed with *T. gambiense* was found to be inactive. This kid became infected on two occasions when inoculated with *T. gambiense*.

(5) A goat which had acquired an immunity to *T. congolense* gave birth to a kid which became infected when inoculated with this trypanosome 16 days after birth. The disease took a chronic course and terminated fatally.

(6) A goat which had acquired an immunity to *T. congolense* gave birth to three kids. One of these was inoculated 43 days after birth with *T. congolense*. Infection resulted and the disease took a normal course.

The conclusion to be drawn is that animals which have acquired immunity are not specially suitable to breed from, in infected countries.

(15) CIUCA (M.). Sur l'Action Protectrice et Immunisante du Sérum des Animaux Trypanosomés traités à l'Emétique de Potassium. [The Protective and Immunising Properties of the Serum of Animals infected with Trypanosomes after Treatment with Potassium Tartrate.]—*Bull. Soc. Path. Exot.* 1914. Nov. Vol. 7. No. 8-9. pp. 670-677.

The author's experiments have been carried out with rabbits, guinea-pigs, and rats, both healthy and infected with the Uganda strain of nagana. For rabbits and guinea-pigs the intravenous administration of the drug has been employed, while rats were treated by intraperitoneal injection, either distilled water or physiological salt solution being used for dissolving the drug.

The trypanocidal effects of the sera of infected animals were tested by mixing them with varying proportions of citrated blood from infected mice, while their protective properties were tested by injecting these mixtures into healthy mice subcutaneously. It was found that the serum albumins of a healthy animal did not alter the power possessed by solutions of emetic ranging from 4 per 1,000 to 1 in 20,000 of rendering trypanosomes motionless and also that stronger solutions than 1 per 1,000 produced slight haemolysis both *in vitro* and *in vivo*.

The blood of animals treated with emetic was found to coagulate more slowly than normal blood.

Guinea-pigs were treated with doses of emetic ranging from 1 to 9 mgm. per 100 grams body-weight on the fourth day after the appearance of trypanosomes in their blood. The latter dose is toxic, and generally causes death within an hour. Five minutes after the injection, blood

withdrawn from the animals failed to set up infection in healthy mice. On the other hand, there was found to be no difference in the effects of serum obtained from infected animals after treatment, and serum from infected guinea-pigs which had not been treated, normal guinea-pigs which had been treated and those which had not, when tested *in vitro*. Not only was there no trypanocidal effect, but the trypanosomes actually retained their power of movement better than in mixtures of infected mouse blood and salt solution or citrate solution.

In another series of experiments the dose of emetic was increased to 12 mgm. per 100 grammes, the animals being bled 5 minutes later. The red and white corpuscles were separated from each other and from the serum and extracted in isotonic salt solution for 24 hours.

Even in these cases neither the serum nor the extracts had any immobilising effect upon the trypanosomes *in vitro*.

It was found that when the emetic was added to the blood, after withdrawal of the latter, the serum and the extracts of the corpuscles caused a very pronounced effect upon trypanosomes, all movement ceasing in less than 5 minutes.

The author also carried out a number of experiments with salvarsan and atoxyl, and the results obtained confirmed those of LEVADITI and MUTERMILCH.

- (16) BRUCE (D.). Classification of the African Trypanosomes Pathogenic to Man and Domestic Animals.—*Trans. Soc. Trop. Med. & Hyg.* 1914. Nov. Vol. 8. No. 1. pp. 1-22.

The author refers to the risks attaching to attempts to classify trypanosomes from the examination of strains which have been maintained for varying lengths of time in laboratories. As an example of this he instances *T. brucei*, which he says has become monomorphic, and quotes ROUBAUD to the effect that it has lost the power of developing or even surviving in the tsetse fly.

With two exceptions—viz., *T. evansi* and *T. equiperdum*—the author has worked in the field with all the trypanosomes referred to in the paper.

The classification is based upon a consideration of three characters of the trypanosomes, their morphology, their action upon animals, and their mode of development in the fly. Simplicity of classification is the author's aim, and he rejects cross-inoculation and serum diagnosis as means of identification as tending to multiply species.

The author refers to the desirability of the adoption of some standard method of studying and describing trypanosomes.

The biometric method of measurement has not yielded the results hoped for, but it is nevertheless considered as a useful means of expressing the "distribution of length" in a given species. It is advised that 1,000 trypanosomes in batches of 100 on consecutive days should be measured to supply data for the construction of a curve, a number of susceptible animals being used for the purpose, or that 1,000 trypanosomes taken at random from various susceptible animals should be drawn and measured, and that, where practicable, 100 trypanosomes from a single white rat on 10 consecutive days should be measured.

Breadth should be measured across the thickest part, including the undulating membrane.

Coloured drawings should always be included and the morphological details accurately described.

With regard to the susceptibility of animals, one must proceed with caution, as there are known instances of profound change in virulence of trypanosomes for given species under certain circumstances. For example, *T. brucei* may be rendered capable of killing white rats in two days after a long series of passages through that species. On the other hand, *T. simiae*, which when obtained from the fly kills monkeys in 10 days, becomes avirulent for the monkey after a single passage through the goat.

Cross-inoculations are difficult to carry out in the field, as immunised animals are not always available and errors may result from variation of virulence in laboratory strains.

Serum diagnosis presents great difficulty in the field owing to the impossibility of keeping a number of small animals.

In the author's classification three main groups are formed :—

A.—The *T. brucei* group. This comprises the polymorphic parasites, which make it possible to separate the parasites contained in it from the other groups by morphology alone. Two of the parasites included in this group develop in the gut of the fly and then pass to the salivary glands, where they complete their development.

B.—*T. pecorum* group. The parasites included in this group are all small and monomorphic. The development takes place in the intestine and proboscis, but the salivary glands are not invaded.

C.—*T. vivax* group. The trypanosomes of this group are monomorphic and very active. Development takes place in the labial cavity and hypopharynx, but not in the intestine or salivary glands.

Group A. comprises :—

- (1) *T. brucei* Plummer and Bradford.
Synonyms : *T. rhodesiense* Stephens and Fantham.
T. ugandae Stephens and Blacklock.
- (2) *T. gambiense* Dutton.
Synonym : *T. nigeriense* Macfie.
- (3) *T. evansi* Steel.
Synonym : *T. soudanense* Laveran.
- (4) *T. equiperdum* Doflein.

Group B. :—

- (1) *T. pecorum*.
Synonym : *T. confusum* Kinghorn and Montgomery.
T. nanum Laveran.
- (2) *T. simiae*.
Synonym : *T. ignotum* Kinghorn and Yorke.

Group C. :—

- (1) *T. vivax* Ziemann.
Synonym : *T. cazalboui* Laveran.
- (2) *T. caprae* Kleine.
- (3) *T. uniforme*.

- (17) SEIDELIN (H.). Notes on the Antagonistic Relations between Trypanosomes and Blood Elements.—*Jl. Path. & Bact.* 1915. Jan. Vol. 19. No. 3. pp. 315-316. With 1 plate comprising 8 figures.

The author describes briefly a process of ingestion of red corpuscles by trypanosomes which he has observed in stained and fresh preparations. The figures are taken from photographs of the various stages of the process as observed in a single preparation of the blood of a rat infected with a trypanosome of the *levisi* type. The phenomenon is said to be uncommon, but, should it prove to be more common than it at present appears to be, it would be of importance as an anaemia-producing factor.

LEISHMANIASIS.

- (18) LAVERAN (A.). Les Leishmanioses chez les Animaux. [Leishmaniasis in Animals.]—*Ann. Inst. Pasteur.* 1914. Sept.-Oct. Vol. 28. No. 9-10. pp. 823-838.
ii. *Ibid.* Nov.-Dec. No. 11-12. pp. 885-912.

i. This paper is a summary of the present state of knowledge regarding Leishmaniasis in the dog. In subsequent papers the following conditions are to be dealt with: Experimental infections produced by *L. infantum*, and *L. donovani*, and natural and experimental infections with *L. tropica*.

Natural infection in the Dog.—

A historical survey is given from the discovery of the condition by NICOLLE and COMTE in 1908, the distribution of the disease being simultaneously dealt with.

The clinical aspect of the disease is referred to, and the views held by different authors regarding the identity or otherwise of the canine disease with human leishmaniasis are summarised. The author concludes that "the probabilities appear to be in favour of the identity of *L. infantum* and the Leishmania that is responsible for natural infections in the dog." It is admitted that there are certain difficulties in the way of accepting this view. The principal objections are:—the inconstant association of the canine disease and the disease in children; the rare discovery of the canine disease in houses where there are human patients; and the failure to find cases of the disease in dogs in India, if the Indian and the Mediterranean disease are identical, as seems probable.

The views of a number of authors regarding the methods of transmission of the parasite are briefly referred to, and the conclusion arrived at by the author is that the real manner of transmission has not yet been definitely discovered.

Diagnosis can only be based upon the discovery of the parasite, and where these are scanty, cultivation should be resorted to. The tubes of medium (simplified Novy) must be incubated at 22° C. for at least a month before being considered as negative.

During life puncture of the liver may be resorted to. To achieve this the puncture must be made in the 10th intercostal space, one or two fingers' breadth from the summit of the dorsal spines. This

method only succeeds when parasites are numerous. The femur may be trephined on its outer face for the taking of material for examination. It is probable that recovery frequently occurs in the dog, but no method of treatment is known.

ii. The effects of inoculation with *L. infantum* in different species.—

The parasite is transmissible by inoculation to the dog, monkey, mouse, rat, and with less ease to the guinea-pig and rabbit. It is preferable to inoculate into either the peritoneum or the liver; a considerable dose should be given. Subcutaneous inoculation generally fails. Inoculations with cultures containing the flagellate stage of the parasite are less successful than inoculations with the parasite as it occurs in the body. The parasites lose virulence under cultivation. Although young dogs are generally more easily infected than old ones, this is not always the case. The parasite can be carried on in series in dogs. The symptoms in dogs may be very slight, and a diagnosis can only be made by the discovery of the parasite. Spontaneous recovery may occur and immunity may be thereby acquired, but if a dog be re-inoculated before recovery is complete, a more severe infection often results.

The author gives a summary of 25 successful inoculations, some of which were made in Tunis by NICOLLE and some by himself in Paris.

In infected dogs the spleen is enlarged, the bone marrow is often red and diffused, but the liver presents a normal appearance. The parasites are generally more numerous in the bone marrow than in the spleen.

The facts with regard to the experimental infection of monkeys closely resemble those already referred to in the dog. Contrary to what might be supposed, passage through monkeys produces no exaltation of virulence but a rapid attenuation. In monkeys the symptoms are more pronounced than in dogs.

In mice inoculated intraperitoneally the infection sometimes remains restricted to the peritoneum, but in other cases it becomes generalised. As with the other species referred to, inoculation with cultures of the flagellate generally fails, the parasites being promptly destroyed by phagocytes.

Inoculation of guinea-pigs fails more generally than it succeeds, and the same holds good for the rabbit.

A single natural case of the infection in the cat has been published, but experimental infection has up to the present failed completely.

Birds, lizards, and frogs have also resisted experimental inoculation.

- (19) ARCHIBALD (R. G.). A Preliminary Report on Some Further Investigations on Kala Azar in the Sudan.—*Jl. R. Army Med. Corps.* 1914. Nov. Vol. 23. No. 5. pp. 479-495.

Inoculation experiments have shown that the following animals are susceptible to infection with kala azar:—The grey monkey, *Lasiopryga calitrichus* (*Cercopithecus sebaeus*), the jerboa (*J. gordoni*), the gerbil (*G. pygargus*), and young dogs.

In the gerbil and jerboa the infection runs a chronic course and does not appear to disturb the health of the host.

Negative results were obtained with the guinea-pig, rabbit, cat, a cheetah, and pigeons.

Cultural experiments.—

The parasite grew readily on N.N.N. medium, and cultures were also obtained on ox blood serum and Buchanan's medium containing 1 per cent. neutral red.

Sheep blood in the place of rabbit blood in the N.N.N. medium was found to inhibit growth of *Leishmania donovani*, but not of *L. tropica*. Aerobic cultures were slightly more luxuriant than cultures put up under anaerobic conditions.

From the results obtained in a number of experiments in which cultures of varying age were subjected to special conditions such as exposure to sunlight, varied temperatures, dilute solution of hydrochloric acid, tap, distilled, and river water, it was inferred that the cultural forms of the parasite possess greater vitality than they are generally credited with. Under unfavourable conditions the tendency is to revert to the cystic stage.

A few experiments designed to show whether specific agglutinins were present in the blood of infected persons or not indicated that there were none. A remarkable result was obtained when a six day old culture was mixed in equal volumes with normal serum from a healthy person. The parasites immediately became motionless with their flagella extended.

A single experiment in which a healthy monkey had administered to it faeces from an infected man yielded a negative result.

The spleen of a heavily infected monkey was emulsified and fed to a healthy monkey by means of a pipette, special care being taken to avoid contact of the pipette with any part of the mouth, thus eliminating the possibility of inoculation. The fed monkey was killed on the 36th day owing to great emaciation and weakness. The peripheral blood showed some normoblasts and cells showing punctate basophilia, but no parasites were discovered in any of the organs. An emulsion of the liver and spleen was inoculated intraperitoneally into a healthy monkey. When killed 123 days later this animal was found to be infected.

In a second feeding experiment, a monkey was infected by the administration of spleen emulsion from a fatal case of kala azar.

A healthy pup was fed on two occasions with material from the liver and spleen of infected monkeys. After two months the animal appeared to be emaciated and anaemic. No Leishmania could be found, but the liver showed oval and rounded cells containing "coccal bodies" identical with those described by SMALLMAN and the author.

The author believes these bodies to be of protozoal origin, and connected in some way with Leishmania.

An attempt to infect a puppy by feeding with cultures yielded a negative result, as did also an attempt to infect a monkey by introducing culture into the vagina.

An attempt to infect a monkey with culture by scarification also failed.

The disease as met with in the Sudan.—

Two forms of the disease are clinically recognisable: an acute form which is fatal within a few weeks or months, and a more chronic form where the patient may live for a year or more.

It is not possible to say from the data available whether there is any difference between the infection of adults and children. In one case in which spleen puncture failed owing apparently to fibrosis, liver puncture yielded material containing cells within which were included "coccal bodies." This patient recovered. The parasites were not seen in this case and cultures were negative, but it is pointed out that this is the third case in which the "coccal bodies" have been found in patients showing all the symptoms of kala azar who have recovered.

A patient showing marked enlargement of the liver and spleen associated with diarrhoea was given several injections of a vaccine prepared from a six day culture, and a sensitised vaccine was also administered. Improvement associated with decrease in size of the liver and spleen resulted, and although the spleen has not returned to the normal size there is a complete absence of fever, and at the time of writing the patient is in fairly good health.

A number of facts which appear to negative the theory that the disease is transmitted by biting insects are set down, and these may be summarised as follows:—

The disease is very uncommon among females who, in view of their mode of living, are especially liable to the bites of insects and bugs. As a rule only a single individual is attacked in a hut, while animals of various kinds which also have free access to the huts have not been found to be infected.

The high percentage of cases in which the parasite is present in the peripheral blood when compared with the distribution of the disease contra-indicates insect transmission.

The disease has not been found in an epidemic form in the Sudan.

There is no evidence of development of the parasite in lice, fleas, or bugs, and experiments with these have yielded negative results only.

Experiments *in vitro* with human serum on cultures, furnish presumptive evidence against the survival of the parasite after entering the human subject by way of the skin.

Attempts to infect *L. callitrichus* by scarification have failed.

In the author's opinion evidence is accumulating which suggests that infection may be by way of the alimentary tract. It is possibly taken in with water or with some intermediate host in the water. Recently some investigations have been made with a species of cyclops taken near Khartoum and flagellates have been found in their intestinal tract. The possibility must therefore be considered whether such crustaceans may be intermediate hosts of such parasites, as they are for such protozoa as entamoeba and trichomonas.

A large number of animals, including dogs, sheep, goats, chickens, cats, squirrels, lizards, pigeons, bats, guinea-fowls, crocodiles, hyaenas, and various species of gazelles have been examined with negative results.

- (20) PATTON (W. S.). The Examination of the Peripheral Blood of 84 Patients, suffering from Kala-Azar at the General Hospital, Madras, during the Period from 15th June 1912 to 15th July 1913.—*Indian Jl. Med. Research.* 1914. Oct. Vol. 2. No. 2. pp. 492-504.

The bulk of this paper consists of a tabulated statement giving brief details of each of the 84 cases.

The method of diagnosis adopted was as follows: Films were made of peripheral blood so that as many as possible of the leucocytes were collected at the ends and sides of the smears. These were stained deeply with Romanowsky and searched, preferably with a dry lens, for parasites. It is said that the parasites were usually discoverable within a few minutes. Two films were made each morning. Examination of the records yields the following information.

The parasite was found in the	1st film in 42 cases.						
" "	2nd	"	13	"			
" "	3rd	"	12	"			
" "	4th	"	5	"			
" "	5th	"	2	"			
" "	6th	"	4	"			
" "	7th	"	1	"			
" "	8th	"	1	"			
" "	9th	"	2	"			
" "	17th	"	1	"			
" "	20th	"	1	"			
		Total ..	84				

- (21) NICOLLE (C.) & CHATTON (E.). Longue Conservation de la Virulence pour l'Homme de la *Leishmania tropica*, en Cultures. [The Long Retention of Virulence for Man of *L. tropica* in Culture.]—*Bull. Soc. Path. Exot.* 1914. Dec. Vol. 7. No. 10. pp. 700-702.

One of the authors has infected himself with a strain of the parasite isolated in 1909 and since passed through 115 generations on simplified Novy medium. The inoculation was made by means of a syringe into the thickness of the skin of the forearm and the culture used was thirteen days old.

- (22) LAVERAN (A.). Infections Expérimentales de Souris, d'un Meriones, d'un Rat et d'un Macaque par la *Leishmania tropica*. [Experimental Infections of the Mouse, Merion, Rat, and Macacus with *Leishmania tropica*.]—*Bull. Soc. Path. Exot.* 1914. Nov. Vol. 7. No. 8-9. pp. 663-670. With 2 figs.

The author's experiments have been carried out to check those published by GONDER regarding the inoculability of the mouse with *L. tropica*. He has used a strain of the same origin as that used by GONDER, viz., one obtained from the Pasteur Institute at Tunis and, as recommended by Row, has used cultures about a month old and not recent ones.

The lesions developing in infected males are thus described:—About the fourth month the testicles become swollen and indurated, and liquid obtained by puncture contains numerous parasites. Little superficial lesions make their appearance on the skin of the scrotum or tail, and the latter may be completely destroyed. Enlargement of the spleen was seen in every case but parasites were not discovered in it, nor were they found in either the liver or the bone marrow.

A female mouse which was successfully infected showed a lesion on the abdominal wall closely resembling oriental boil, and there was also a generalised infection. Parasites were present in large numbers in this lesion, as also in the liver. They were present in moderate numbers in the spleen, but scanty in the bone marrow.

In addition to mice, of which six out of twelve were successfully inoculated, the author has infected one out of three merions* caught in Tunis. In this case lesions exactly like those found in the male mice commenced to develop about the fifth month. As in the case of the mice, there were no parasites discoverable in the liver, spleen, or bone marrow.

A rat inoculated into the testicle with material derived from one of the infected mice developed a local lesion only. A similar result followed the inoculation of a rat direct into the testicle with culture of the same parasite.

A macacus monkey, inoculated with material derived from an infected mouse, showed little nodular skin lesions after an interval of about nine days. This virus was more active than that of Delhi sore with which some of the author's earlier experiments were made, but the lesions produced very much resembled each other.

While the author does not feel justified in drawing any conclusion from the results of these experiments he states that they appear to contra-indicate the identity of *L. infantum* and *L. tropica*.

SPIROCHAETOSIS.

- (23) FANTHAM (H. B.). The Granule Phase of Spirochaetes.—*Jl. Trop. Med. & Parasit.* 1914. Dec. Vol. 8. No. 3. pp. 471-484.

In this paper an attempt is made to throw light on the much-discussed subject of the granule phase of spirochaetes and in it are incorporated results of the author's recent work.

The conclusions arrived at may be summarised as follows:—

(1) The formation of granules from spirochaetes is generally admitted, their significance only being in dispute.

(2) Danger attaches to generalisation, as it has never been asserted that all the granules seen in the tissues of infected ticks were of spirochaetal origin.

(3) The author has seen granular structures in various tissues of the ticks similar to those figured by MARCHOUX and COUVY, but often they were not so marked as represented in the figures of those authors.

(4) The full details of climatic conditions, especially humidity and temperature under which the experimental ticks were kept, must be recorded.

(5) The view is expressed that MARCHOUX and COUVY's postulate of ultra microscopic spirochaetes is weak.

(6) Small spirochaetes have been seen to emerge from granules contained in tissues from ticks by the use of dark ground illumination.

* *Meriones*: a genus of Muridae.

(7) There is evidence to show that granules grow into spirochaetes *in vitro*.

(8) The author has observed the formation of granules (coccoid bodies or spores) from *Spirochaeta bronchialis*. The spirochaetiform phase of this parasite dies rapidly outside the body.

(9) SERGENT and FOLEY have shown that the spirochaete of relapsing fever in North Africa possesses a small but virulent form which is assumed during a pyrexial periods in man, and during a period following an infecting meal in the louse.

PROTOZOA.

(24) MACFIE (J. W. Scott). Notes on some Blood Parasites collected in Nigeria.—*Ann. Trop. Med. & Parasit.* 1914. Dec. Vol. 8. No. 3. pp. 439-468. With 2 coloured plates and 1 text fig.

This paper is divided into six sections dealing with the following :—

(1) The occurrence of babesiosis in domesticated animals in Nigeria ; (2) A spirochaete found in the blood of a guinea-pig ; (3) Bacilliform bodies found in the red corpuscles of a rat ; (4) A disease of fowls characterised by inclusions in the leucocytes ; (5) Blood parasites of lizards and toads ; (6) The occurrence of a spirochaete in the gut of *G. tachinoides*.

(1) Fifteen goats, seventeen Hausa cattle, two dwarf cattle, and twenty-five sheep were examined for intra-corpuscular blood parasites, and they were detected in two Hausa cattle, two dwarf cattle, and eleven sheep.

No evidence was available that the animals had shown any symptoms of illness. The blood was taken from animals about to be slaughtered.

In most cases the parasites were numerous. The description of the morphology of the parasite and the coloured illustration of it, indicate its close resemblance to *Theileria parva*, as stated by the author. But a form is figured and described which exactly agrees with the "maltese-cross" form of *Nuttallia equi*.

"Blue bodies" were not found, but apparently only blood smears were examined.

An attempt was made to cultivate the parasite, 1-10 cc. of 50 per cent. glucose solution being added to 8 cc. of defibrinated blood, the tubes being incubated at 37° C. For the experiment the blood of an infected ram was used. Parasites were fairly numerous in the blood and "dividing forms" did not exceed 4 per cent.

After six hours incubation "dividing forms" numbered 19 per cent., and at 24 hours there were 21 per cent. of these forms.

Parasites appeared to maintain their full vitality up to 90 hours, after which they seemed to decrease in numbers.

One of the Hausa cattle was also found to be infected with a Babesia. These were much larger parasites. Only two imperfect films were available for examination.

Extra-corporeal forms containing a large mass of chromatin and a solid looking cytoplasm were found, but intra-corporeal forms showed irregular shaped bodies with, in some cases, as many as six or seven pieces of chromatin. It is suggested that this may possibly be a new species.

In one of the dwarf cattle a parasite apparently identical with *B. bigeminum* was found.

Babesiosis in guinea-pigs.—Two babesia-like parasites have been found in these animals. They have been known to be present in the blood of an animal for months without producing any symptoms.

Paraplasma flavigenum.—This is said to resemble closely some of the forms of *Theileria parva*. It is indistinguishable from *Paraplasma flavigenum* in human blood taken from people infected with yellow fever and in the blood of guinea-pigs inoculated from such cases. In view of the endemicity of yellow fever in Nigeria the possibility is suggested that the presence of the parasite in the guinea-pig represents a natural infection.

The second parasite found in guinea-pigs resembles *Paraplasma flavigenum* but is coarser in structure and invariably causes a "stippling" of the invaded cell.

The coarseness of this "stippling" appeared to be dependent upon the intensity of the strain.

A heavily infected guinea-pig remained apparently healthy for five months, the parasites varying in number from day to day.

The name *Paraplasma cobayaee* is suggested for this parasite.

(2) Spirochaete in the blood of a guinea-pig.—This organism was fortuitously isolated from the blood of a guinea-pig with which experiments were being made for the cultivation of *Paraplasma flavigenum*.

Bass's method was used and spirochaetes appeared after 46 hours incubation at 37° C. They increased up to the 79th hour when they were innumerable. All spirochaetes had vanished by the 8th day.

The parasites ranged from 2 to 9 microns in length, with exceptional ones measuring 14 microns; they showed from two to six undulations, and had blunted ends.

The parasites were still capable of multiplying on transplantation at the 100th hour, although they had undergone marked structural changes.

(3) Bacilliform bodies found in the red corpuscles of a rat.—At the time of writing the author had not had the opportunity of consulting recent literature, but since doing so he is convinced that the bodies which he saw in the blood of a rat were *Grahamella*.

(4) Disease of fowls characterised by inclusions in leucocytes.—This condition appears to be well known among the natives.

Symptoms.—The earliest symptom is that the infected bird stands still with its head and tail drooping, then the wings begin to droop and the bird becomes unsteady, standing with its legs wide apart. Finally it falls and remains motionless until death occurs. Diarrhoea is a marked symptom. There is not constantly any anaemia. Death generally occurs in two days.

Examination of the blood revealed the presence of chromatin granules in the cytoplasm of leucocytes. These granules varied in size and shape, the majority were large and rounded or annular, but club-shaped and signet forms occurred. Similar bodies were found in great numbers in the cells in smears from the liver and spleen, but they were often much larger and crowded together to form solid masses.

In the earlier stages of the condition red corpuscles were found, the nuclei of which stained of a rather brown tint with Giemsa. In the later stages the cytoplasm of such corpuscles was more or less stippled with brownish or purplish granules.

Twenty-eight toads (*Bufo regularis*) were examined. Trypanosomes were found in 4, microfilariae in 3, and haemogregarines in 8. Of 38 lizards (*Agama colonorum*) examined, one showed trypanosomes, 13 microfilariae, 2 haemogregarines, and 3 haemocystidia.

(6) A spirochaete in the gut of *G. tachinoides*.

Spirochaetes were found in immense numbers in the posterior part of the gut of a fly, which was dissected in the course of some experiments. This fly had fed on a normal guinea-pig for some days, but the animal showed no evidence of infection. The parasites varied in length from 7 to 35 microns, they were extremely slender, and their ends were blunt.

(25) BOUILLIEZ (M.). *Exposé des Travaux en Cours au Laboratoire de Fort-Archambault.* [An Outline of the Work in Hand at the Fort Archambault Laboratory.]—*Bull. Soc. Path. Exot.* 1914. Nov. Vol. 7. No. 8-9. pp. 685-694.

This report was not intended for publication, but it was thought advisable that it should be published.

Human and animal trypanosomes, with the methods of transmission, malaria, bilharziosis, and goitre are dealt with.

Human trypanosomiasis has been discovered along the course of the Bahr Sara, and it appears to have been long established there. No cases have been found along the Shari and in the valleys of Bahr Kô, except in a few villages near Fort Archambault among people who admit having lived in the infected districts of Crampel, Sibut and Bangui.

Animal trypanosomiases.—The author has had the opportunity of investigating these more particularly in equidae, as the cattle, sheep,

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and goats, of which there are large numbers in Chad, do not come quite so far south as Fort Archambault. In horses the only trypanosome found appears to be *T. pecaudi*.

A number of sheep, goats, and cattle have been examined on their way through but no trypanosomes have been detected. The author was not in a position to carry out inoculation tests for the detection of infection in these animals. *T. lewisi* is very common among rats.

Two donkeys out of 22 which were passing through, were found to be infected with a trypanosome which appeared to be *T. cazalboui*.

At the time of writing, it had not been possible to investigate the question of the species of biting flies present in the area, but *G. morsitans* and *G. tachinoides* had been discovered.

Malaria.—A small number of examinations have been made to ascertain the frequency of malaria, and the figures show a percentage of 79. The majority of the parasites were of the *P. praecox* type, but *P. vivax* and another unidentified organism have been seen.

Bilharziosis of the bladder and intestine both occur, but some transmission experiments carried out with monkeys were not complete at the time of writing.

Goitre is very common among the natives.

HELMINTHS.

- (26) NICOLL (W.). On the Migration of the Larvae of *Onchocerca gibsoni* through the Capsule of the Worm Nodule.—*Ann. Trop. Med. & Parasit.* 1914. Dec. Vol. 8. No. 3. pp. 609-621.

The first three pages of this communication are occupied by a summary of the literature regarding this parasite.

The author's observations may be summarised as follows:—

Attempts were made to ascertain whether larvae were able to escape from the worm nodules and pass through the uninjured skin of the host and thus gain the exterior, as stated by BREINL.

In a number of experiments, pads soaked in sterile water were applied over nodules for periods ranging from $1\frac{1}{2}$ to 3 hours at different times during the day, the water being subsequently examined for embryos. The results in every case were negative, as were also those in which the pads were replaced by small vessels containing water.

In further experiments carried out with nodules excised from carcases some positive results were obtained.

Two freshly excised nodules were obtained, one of which was surrounded by muscle and the other by connective tissue. The muscle was cut away from the nodule and divided into two portions. These two portions and the two nodules were placed in separate capsules containing filtered rain water. Two of these capsules were incubated

at 37° C. and the other two were left at room temperature (21° to 26° C.). The water was replaced at frequent intervals, each change being examined after centrifuging.

The larger (incubated) nodule and the piece of muscle which had been cut from it and left at room temperature gave negative results throughout.

The incubated piece of muscle yielded one larva after 2½ hours, and the nodule which had been left at room temperature yielded two larvae at the end of 6 hours and another, 3 hours later.

In a second experiment eight nodules were used, and the following table indicated the manner in which they were treated together with the results obtained.

Experiment started at 1 p.m., 30th July.

	30th July.			31st July.	1st August.
	2.15 p.m.	5.15 p.m.	9 p.m.	9 a.m.	12 noon.
5. Acidulated water, 37° C.	4	0	2	0	0
6. Acidulated water, Room temperature..	0	3	0	0	0
7. Ammoniated water, 37° C.	2	2	0	6	1
8. Ammoniated water, Room temperature..	2	12	0	0	0
9. 37° C.	42	8	0	0	3
10. Room temperature ..	439	2,000	Very numer- ous.	30	7
11. 37° C.	47	18	0	0	0
12. Room temperature ..	42	230	20	14	0

When the nodules were examined after the experiment, it was found that in Nos. 5 and 6 the worm appeared as a caseous mass. In Nos. 7 and 8 the worm was in good condition, but the larvae were all dead. A similar condition was found in 10 and 12, but in 9 and 11 the interior of the nodule was in a state of putrefaction.

Nodule 12 had had made in it two cross-shaped incisions $\frac{1}{8}$ th inch deep before the experiment, but the others were not so treated. The absence of any cuts or perforations was confirmed by examination of the nodules after the experiment.

Three further series of experiments were made on much the same lines and the details are given in tabular form showing the methods of treatment and the results obtained.

These may be summarised as follows :—

The experiments go to show that *Onchocerca* larvae can escape from the nodules, usually in small numbers, but at times in comparatively large numbers.

The fact that the embryos were found to be incapable of maintaining their existence in water for more than two days must be placed against the view that the infection is water-borne, although it cannot be excluded. Water-born infection, either direct or through an intermediate host, must be considered as a possibility.

Further bias in favour of water-borne infection is the analogy between *Onchocerca* and guinea-worm. On the other hand, the adult worm is so closely allied to the Filariae that insect transmission seems to present the greatest measure of probability.

If it be the case that larvae emerge through the skin of their own accord some non-biting insect might become infected, but in that case it would be difficult to explain re-inoculation.

- (27) MITRA (S. B.) & GANGULY (H. C.). Canine Filariasis.—*Vet. Jl.* 1915. Jan. Vol. 71. No. 475. pp. 40-42. With 1 text fig.

The filariae which are briefly described in this note were found in the blood of a kangaroo hound dog. Their presence was associated with a variable temperature, and they appeared to be less numerous in the morning than in the evening.

The average length of the parasites was 300 microns and they were therefore longer than *Acanthocheilonema recondita* and *A. dracunculoides*, which are said not to exceed 230 microns.

Their size places them between *Dirofilaria repens* and *D. immitis*, and the authors are inclined to identify them with the latter.

- (28) SERGENT (Edm.). Première Note sur les Phlébotomes Algériens. [First Note on the Algerian Phlebotomes.]—*Bull. Soc. Path. Exot.* 1914. Nov. Vol. 7. No. 8-9. pp. 660-662.

The author gives the following list of species of Phlebotomus and their geographical distribution :—

Coast—

Phlebotomus papatasii Scopoli. Very common in July, August, and September.

Upper Plateaus (from 800 to 1,000 metres)—

Phlebotomus papatasii Scopoli.

„ *minutus* var. *africanus* Newstead.

„ *perniciosus* Newstead.

All these occur during the first three weeks of September only.

Sahara—

Phlebotomus papatasii (from the middle of May till October at Beni-Ounif-de-Figuig).

At Biskra *P. papatasii* and *P. minutus africanus* appear in about equal numbers, but *P. perniciosus* is more rarely seen.

- (29) LANE (C.). Suckered Round-worms from India and Ceylon.—
Indian Jl. Med. Research. 1914. Oct. Vol. 2. No. 2. pp, 655-669.
 With 8 plates.

The following is a list of the parasites described in this paper:—

Heterakinae—

- Heterakis bosia*, n. sp., Tragopan pheasant.
 " *putaustralis*, n. sp., Domestic fowl.
Ganguleterakis gangula, n. gen., n. sp., *Mus decumanus*.
Ascaridia hamia, n. sp., Domestic fowl.
Kathlania kathlena, n. gen., n. sp., *Chelone midas*.
 " *tonandia*, n. sp. *Chelone midas*.
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MISCELLANEOUS.

- (30) SEIDELIN (H.). *Klossiella* sp. in the Kidney of a Guinea-pig.—
Ann. Trop. Med. & Parasit. 1914. Dec. Vol. 8. No. 3. pp. 553-564. With 2 plates comprising 27 figures.

The parasite described in this paper has been found in the kidneys of a guinea-pig at the Medical Research Institute, Yaba, Nigeria.

To the naked eye the kidneys presented a normal appearance, and apart from the presence of the parasite in the renal epithelium the microscopic alterations were similar to those seen in many animals infected with yellow fever as was the case with this guinea-pig.

The coccidium-like parasite was found in larger or smaller numbers in every section examined.

The earliest stage of the parasite appears to be a small rounded body measuring about 2 microns in diameter with an irregular shaped nucleus and scanty cytoplasm.

The parasite increases in size until it measures about 6 microns when the nucleus begins to divide up into daughter nuclei which eventually dispose themselves at the surface of the cytoplasm. The daughter cells are formed apparently by a process of budding, and the number varies from 16 to 20. These again become divided and produce about 30 small fusiform structures, measuring about 8 microns by 1.5.

The parasites occur in the epithelium of the convoluted tubes and of the loop of Henle.

Parasites were not found in the straight tubes nor in the pelvis.

No opportunity occurred to follow up the life cycle of the parasite, as it was found in sections which were being examined in the course of other observations.

Should the parasite prove to be a new species, the name *Klossiella cobayae* is suggested.

- (31) WENYON (C. M.) & LOW (G. C.). The Occurrence of Certain Structures in the Erythrocytes of Guinea-pigs and their Relationship to the So-called Parasite of Yellow Fever.—*Jl. Trop. Med. & Hyg.* 1914. Dec. 15. Vol. 17. No. 24. pp. 369-372. With 1 coloured plate.

This paper deals with the discovery by the authors of certain bodies within the red corpuscles of healthy guinea-pigs which appear to be identical with those described by SEIDELIN, and MACFIE and JOHNSTON, and called by them *Paraplasma flavigenum*, which they found in the red blood corpuscles in cases of yellow fever and which were said to be inoculable to guinea-pigs in series.

AGRAMONTE and SCHILLING-Torgau have already published observations of the same nature.

The bodies in question are particularly numerous in newly-born animals, and this fact contraindicates their parasitic nature, as placental transmission is exceedingly rare in parasitology. With increasing age they disappear.

It is probable that the bodies represent some of nuclear material.

In suitably stained preparations the bodies may be seen as minute red granules, one or more being present in a single cell. In some cases the red speck is associated with bluish-grey material which suggests cytoplasm. The arrangement of this material is very variable. The explanation of its presence is difficult to furnish. In some cases the bodies have a definite ring shape with a lateral red dot much like a ring form of piroplasm save that they are much smaller.

The authors believe that the bodies are real structures and not artefacts. The remainder of the paper deals with the possible connection between these bodies and yellow fever.

- (32) SMITH (A.) & MITTER (S. N.). A Brief Note on an Outbreak of Septicaemia among the Monal Pheasants of the Calcutta Zoological Garden.—*Vet. Jl.* 1914. Jan. Vol. 71. No. 475. pp. 37-40.

The authors believe that the disease responsible for the deaths of the pheasants was identical with that described by GAMALIA in 1888 as occurring among fowls in Southern Russia.

They isolated an organism which agreed in its morphological and cultural characters with the *Vibrio metschnikovi*.

In experimentally inoculated rabbits and fowls death took place within 24 hours provided the animals were young. Adult birds and rabbits offered a considerable degree of resistance.

In natural cases the lesions appeared to be confined to the alimentary canal, which showed evidence of very severe inflammation.

The organism is said to occur "in thick curved blunted rods, or resembling cocci or small bacteria in the short thicker specimens, or in spiral filaments."

The organism is stainable by the simple anilin dyes, but not by Gram's method.

In broth it produces turbidity and a surface scum.

On agar there is a luxuriant yellowish-white growth.

In stab gelatin there is liquefaction and gas formation. On potato a yellowish brown growth develops.

In eggs inoculated according to Huppe's method the white is converted into a turbid yellow liquid and the yolk becomes quite black.

Indol was developed in the cultures.

- ✓(33) HOLMES (J. D. E.). A Note on the Effect of Heat on the Rinderpest Immune Bodies.—*Bull. No. 43. Agricultural Research Institute. Pusa*, 10 pp. 1914. Calcutta: Superintendent Government Printing. India.

The experiments recorded in this paper were carried out with the double object of ascertaining: (1) whether exposure to a moderately high temperature for several days, or to a high temperature for a short time had any detrimental effect on the serum; (2) the effects of sterilisation on the potency of the serum.

Certain tests carried out by LINGARD appeared to show that the subjection of the serum to moderate temperatures for considerable periods (some months) produced deterioration.

Three sets of experiments were carried out. In the first the serum was exposed to a temperature of 45° C. for 7 days before use. This degree of heating was found to be without effect upon the protective power of the serum.

In the other two series of experiments the serum was heated to 55° and 65° C. respectively for one hour, and in both instances the original potency of the serum was retained.

The conclusions are drawn that anti-rinderpest serum can be sterilised with safety, and that the action of the serum is not dependent upon a complement present in itself.

- (34) MCLEOD (J. W.) & SOGA (A. R. B.). A Simplified Method for the Cultivation, in Fluid Media containing Coagulable Albumin, of Bacteria requiring Anaerobic Conditions, notably the Pathogenic Spirochaetes.—*Jl. Path. & Bact.* 1914. Oct. Vol. 19. No. 2. pp. 210-213. With 1 text fig.

A tube is fitted with an india rubber bung carrying a piece of glass tubing which does not quite reach the lower surface of the bung. Above the bung the tube is drawn out and bent over at an acute angle. The tube is filled to half or two-thirds of its depth with broth, which is then sterilised in the autoclave. When the liquid is cool sterile rabbit kidney is introduced. The tube is inoculated by dropping into it a bead through which is passed a piece of cotton wool soaked in the seed material. This ensures the seed material shall be near the piece of kidney where conditions are most suitable for growth. Finally ascitic fluid is run in until the level of the liquid is within half the length of the bung from the top of the tube. The bung is then pushed in, the liquid rises up in the tube and when it reaches the end of the drawn out tube this is sealed off.

The method is not applicable to gas producing bacteria.

The authors have been able to cultivate three strains of spirochaetes received from NOGUCHI by this method, 50 to 60 per cent. of the cultures being successful.

- (35) CHATTERJEE (G. C.). A Culturable Free Living Flagellate and the Determination of the Lethal Value of Certain Chemicals thereon.—*Indian Jl. Med. Research.* 1914. Oct. Vol. 2. No. 2. pp. 594-603. With 1 coloured plate.

The flagellate, which discovered in a sample of tank water was found to grow very well in broth or peptone water.

The organism possessed two flagella, a rudimentary undulating membrane, and basal granules. The morphology varied somewhat according to the medium used for cultivation. The large forms which developed in broth measured 10 to 20 microns in length by four in width, and the flagella were of unequal length measuring 10 and 5 microns.

In salt solution shrunken elongated forms were found. In tap water large spherical forms developed. The identity of these different types was proved by cultivation experiments.

Multiplication occurred at 18° and 20° C., but it was more vigorous at body temperature. At 40° C. multiplication ceased and at 45° C. the parasite died in five minutes.

Tabular statements are given of the effects of a number of chemical substances used on the lines of the Rideal Walker tests.

REPORTS.

- (36) GOLD COAST. Report on the Veterinary Department for 1913, by W. P. B. BEAL. 1914. 24 pp. f'cap. Accra : Printed at the Government Press.

Anthrax.—One suspected case occurred in a horse, the animal being destroyed.

Contagious Bovine Pleuro-pneumonia.—One outbreak occurred at Colebro in N.W. Ashanti and one at Nantong in the Northern Territories.

Trypanosomiasis.—Treatment of horses suffering from this disease has been carried out on the same lines as before (see this *Bulletin*, Vol. 1, p. 188), but the orpiment was given *in bolus* instead of in drenches.

The atoxyl injections were repeated on the 6th and 7th days because there is a rise of temperature observed from the 5th to the 8th days.

There is evidence to show that the cures effected are not permanent, the apparently cured animals harbouring trypanosomes in the blood.

Tabanidae.—The following species have been caught : *T. besti* Surc., *T. kingsleyi* Ric., and *T. marmoratus* Surc.

The commonest trematode worm is *Gastrodiscus aegyptiacus*, and it is estimated that 75 per cent. of the horses are hosts of this parasite. It is easily expelled by anthelmintics and aloes.

(37) BRITISH EAST AFRICA. Annual Report 1912-1913. Dept. of Agriculture. [Veterinary Department by R. J. STORDY. pp. 23-41.]

East Coast Fever.—The inoculation with spleen or gland pulp according to Theiler's method is considered to be inapplicable owing to the high death-rate caused, and it is stated that a method of vaccinating with infective spleen pulp, peptone, and blood from an immune animal is being elaborated at Kabete Laboratory. Investigations have been made into the "frequent dipping" method of dealing with the disease.

Rinderpest.—The mortality caused by this disease cannot be estimated, but it has occurred in all but a few districts.

It is reported the Masai have no desire to escape the disease and even introduce it, as they are willing to pay the toll in young stock in order to have immune survivors.

Attention is drawn to varying virulence of the strains and the varying degree of its rapidity of spread.

Pleuro-pneumonia.—No outbreaks of this disease have been recorded.

Quarter Evil.—Outbreaks have occurred, but a vaccine has been prepared to combat this disease.

Anaplasmosis.—This disease has been slightly more prevalent than during the preceding year.

Trypanosomiasis of Cattle.—No case has come under notice except a few among cattle imported from Uganda for experiment.

Ephemeral Fever or Three Days' Sickness.—Several outbreaks have been recorded from the neighbourhood of Nairobi. This disease is due to a specific organism which is present in the blood of sick animals, and the disease can be transmitted by the inoculation of such blood.

Animals of all ages and breeds are susceptible, but young animals appear to be more resistant than adults, and in animals in fat condition the disease runs a more rapid course than in those in poor condition.

The period of incubation after blood inoculation is two or three days, and the period of immunity resulting from infection is six weeks. The blood of a recovered animal is non-infective.

The symptoms are:—Elevation of temperature with the usual external evidences of fever, watery discharge from the eyes and nose, painful lameness in one or more limbs, which may rapidly pass from one limb to another, stiffness of the whole body and especially of the neck, the latter being associated with difficulty in swallowing, constipation with faeces covered with mucus. Within 48 hours the symptoms begin to abate and by the third day the animal is generally convalescent.

The only constant lesion is enlargement of the lymphatic glands, particularly the prepectoral group.

The disease is seldom or never fatal, but a fatal result may follow an attempt to drench an animal that cannot swallow.

Although it has been suggested that the disease is insect transmitted, there is no evidence to that effect.

The number of cattle affected ranges from 12 to 33 per cent. of the total number in the herd.

Horse Sickness has been very prevalent.

A disease closely resembling horse sickness, but which appears to be non-transmissible by blood inoculation has been observed.

Epizootic Lymphangitis is widespread in the country, and possibly a quarantine station will have to be established at Rumuruti for importations from the North. "606" was found to be useful in the early stages of the disease.

Ulcerative Lymphangitis has been reported mainly from the Uasin Gishu Plateau.

Experiments are in hand regarding this disease.

Strongylosis in Sheep is very widespread and is responsible for great losses. Drenching with lysol has had the most beneficial results.

Warty Papillomata of the face, lips, and feet of Sheep.—This is a common condition on the Uasin Gishu Plateau.

In the early stages there are dry warty tumours on the lips. These increase in size and become horny. If peeled off a tender raw surface is left. The ears and coronets may also be affected.

In pure and half-bred imported sheep the course of the disease is generally acute and the mortality higher than in indigenous hairy sheep. Goats are not affected, and the disease appears to be contagious.

Swine Fever.—Three outbreaks have occurred, with a mortality of 100 per cent.

This is just a possibility that a protective serum will be obtainable, as one pig at the laboratory appears to be acquiring a resistance through the injection of virus attenuated by heat.

Tick fever in the dog has been as prevalent as usual, and trypanblue has given good results.

A form of distemper, which appears to be somewhat different from the English type of the disease has been prevalent.

Rabies.—A number of cases occurred in dogs as a result of the bites of jackals, and though a number of natives were bitten no cases of hydrophobia have resulted. It is said that the form of rabies occurring in British East Africa resembles that described as occurring in Senegal, which chiefly affects dogs.

(38) EGYPT. Annual Report of the Veterinary Service for 1913.
Ministry of Agriculture. 1915. 27 pp. Cairo: Government Press.

Cattle Plague.—This disease has been responsible for 2,314 deaths, including 490 following double inoculation in outbreaks. The death-rate from natural infection was about 0·14 per cent. The number of cattle inoculated was 178,495. Of these, 569 died of rinderpest and 1,452 of other diseases, including 908 of Texas fever. In areas where double inoculation was systematically carried out, no subsequent cases occurred. The percentage of deaths following the inoculation was 1·12.

Rabies was observed in 74 cases among animals, which included two cats, one donkey, and one wolf, the remaining cases being in dogs.

Sixty-six cases of glanders were detected, and 20 of epizootic lymphangitis.

Five hundred and forty-four cases of anthrax were reported, of which 527 were in sheep.

Sheep-pox cases numbered 132.

Three hundred and forty cases of foot-and-mouth disease occurred.

Ten cases of trypanosomiasis were detected. One of these was in an ox, in which species the disease has not previously been detected in Egypt. The parasite appeared to be identical with *T. theileri*.

Filariasis was detected in two camels.

Piroplasmosis was reported in 946 cases, mainly due to double inoculation.

No cases of stiff sickness were reported.

Eighty-nine cases of contagious bovine pleuro-pneumonia were reported.

Three horses, which had been treated for trypanosomiasis two years previously with apparently complete success, were tested by the inoculation of their blood into dogs. In each case the dogs failed to become infected and were subsequently proved to be susceptible.

(39) SINCLAIR (J. M.). Report of Enquiry into the Health of Cattle in Texas [MS.]. Dated Dec. 31st. 1914.

Redwater.—This disease is confined to the Southern half of Texas, and is slowly being stamped out. Young animals appear to be more seriously affected than is the case in Rhodesia.

The effects following inoculation of pure bred stock are practically identical with those observed in Rhodesia except that the mortality due to inoculation is put at 3 per cent., and on subsequent exposure to infection at 5 per cent., but the latter figure is said to be sometimes much higher.

"In Rhodesia the heavy mortality has been attributed to anaplasmosis or gall sickness, which, according to Theiler and other observers, is a disease entirely different from redwater. The results of Bevan's work during the last two years have caused him to doubt the separate identity of the two diseases—viz., redwater and gall sickness—and in this he is supported by the fact that conditions exactly the same, as far as I can judge, are regarded by Francis and other American observers as part and parcel of redwater."

Nodular Vaginitis.—The nodular condition of the mucous membrane and the muco-purulent discharge may make their appearance when the animal is a few weeks old and persist for three or four years. Sinclair thinks the weight of evidence is with those who attribute abortion, retention of the placenta, and diseased conditions of the uterus to oviducts and ovaries which cause sterility. The condition is widely spread in the United States, and though no Texan stockowner was met who knew of the disease, its discovery in a large proportion of animals at the Meat Inspection Department at Fort Worth proves its existence.

Infectious Abortion is very widespread in Texas, especially in dairy herds.

Anthrax and black quarter are responsible for great losses. The Pasteur method of vaccinating with vaccine prepared by commercial firms has yielded very unsatisfactory results.

Psoroptic mange occurs to a considerable extent.

Foot-and-mouth disease was not existent in Texas at the time of writing, but it had broken out in 13 States in the United States a month or two previously.

Contagious pleuro-pneumonia does not occur.

Tuberculosis.—This is very prevalent among dairy cattle, and has been frequently demonstrated among the range cattle.

The report concludes with suggestions based upon the information obtained as to the steps that should be taken if animals are imported into Rhodesia from Texas.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 2, No. 4, pp. 203-204.]

Anaplasmosis.

- (40) SANGIORGI (G.). Reperto di "Corpi Anaplasmasimili" nel Sangue dell'Uomo e degli Animali. [The Discovery of Anaplasma-like Bodies in the Blood of Man and Animals].—*Pathologica*. 1915. Jan. Vol. 7. No. 149, pp. 27-29.

Leishmaniasis.

- (41) CHRISTOPHERSON (J. B.). On a Case of Naso-oral Leishmaniasis (corresponding to the Description of Espundia); and on a Case of Oriental Sore, both originating in the Anglo-Egyptian Sudan.—*Ann. Trop. Med. & Parasit.* 1914. Dec. Vol. 8. No. 3, pp. 485-494. With 2 plates.
- (42) MACKIE (F. P.). The Progress of Kala-Azar in a Localised Community.—*Indian Jl. Med. Research*. 1914. Oct. Vol. 2. No. 2, pp. 505-509.
- (43) MACKIE (F. P.). Note on Some Bodies of Unknown Nature found in the Faeces of Kala-Azar Patients.—*Indian Jl. Med. Research*. 1914. Oct. Vol. 2. No. 2, pp. 510-515. With 1 coloured plate comprising 3 figs. and 1 map.

Tick Paralysis.

- (44) TODD (J. L.). Tick Paralysis.—*Jl. of Parasitology*. 1914. Dec. Vol. 1. No. 2, pp. 55-64.

Biting Flies and Ticks.

- (45) CORNWALL (J. W.) & PATTON (W. S.). Some Observations on the Salivary Secretion of the Commoner Blood-sucking Insects and Ticks.—*Indian Jl. Med. Research*. 1914. Oct. Vol. 2. No. 2, pp. 569-593. With 2 charts.
- (46) NUTTALL (G. H. F.). Tick Abnormalities.—*Parasitology*. 1914. Oct. Vol. 7. No. 3, pp. 250-257. With 11 text figs.
- (47) NUTTALL (G. H. F.). Penetration of Ixodes beneath the Skin.—*Parasitology*. 1914. Oct. Vol. 7. No. 3, pp. 258-259.
- (48) SCHWETZ (J.). Quelques Observations Préliminaires sur la Morphologie et la Biologie de la Larve, de la Nymphe, et de l'Image de l'*Auchmeromyia luteola* Fabr.—[Preliminary Observations regarding the Morphology and Biology of the Larva, Nymph and Imago of *Auchmeromyia luteola*].—*Ann. Trop. Med. & Parasit.* 1914. Dec. Vol. 8. No. 3, pp. 497-507.

Helminths.

- (49) CORT (W. W.). Larval Trematodes from North American Fresh-water Snails.—*Jl. of Parasit.* 1914. Dec. Vol. 1. No. 2, pp. 65-84. With 15 text figs.
- (50) SEURAT (L. G.). Sur un Nouveau Gongylonème, Parasite de la Gerbille. [A New Gongyloneme Parasite of the Gerbil].—*C. R. Soc. Biol.* 1914. Dec. 11. Vol. 77. No. 31, pp. 521-524. With 4 text figs.

- (51) SEURAT (L. G.). Sur une Filaire Péritonéale du Macroscélide. [A New Peritoneal Filaria of the Macroscelida.]—*C. R. Soc. Biol.* 1914. Dec. 11. Vol. 77. No. 31, pp. 524-527. With 3 text-figs.
- (52) SEURAT (L. G.). Sur un Nouvel *Ophistostomum* Parasite du Gundji. [A new Ophistostomum parasitic in the Gondi.]—*C. R. Soc. Biol.* 1915. Feb. 5. Vol. 78. No. 2, pp. 20-22. With 4 text-figs.

Protozoa.

- (53) CRAIG (C. F.). New Varieties and Species of Malaria Plasmodia.—*Jl. of Parasit.* 1914. Dec. Vol. 1. No. 2, pp. 85-94.
- (54) FANTHAM (H. B.) & PORTER (A.). The Morphology, Biology, and Economic Importance of *Nosema bombyi*, n. sp., Parasitic in various Humble Bees (*Bombus* spp.).—*Ann. Trop. Med. & Parasit.* 1914. Dec. Vol. 8. No. 3, pp. 623-638. With 1 plate.
- (55) LAVERAN (A.). & FRANCHINI (G.). Infezione dei Mammiferi per Mezzo di Flagellati di Vertebrati. [The Infection of Mammals by Means of Flagellates of Vertebrates (? Invertebrates).] *Pathologica*. 1915. Jan. Vol. 7. No. 149, pp. 29-31.
- (56) PORTER (A.). The Morphology and Biology of *Herpetomonas patellae*, n. sp., Parasitic in the Limpet, *Patella vulgata*, together with Remarks on the Pathogenic Significance of Certain Flagellates found in Invertebrates.—*Parasitology*. 1914. Oct. Vol. 7. No. 3, pp. 322-329. With 17 text-figs.

Unclassed.

- (57) SEIDELIN (H.). Notes on the Pathology of Yellow Fever in Guinea-pigs.—*Jl. Path. & Bact.* 1915. Jan. Vol. 19. No. 3, pp. 317-320. With 2 plates comprising 8 figs.

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BABESIASIS (PIROPLASMOSIS).

- (58) WENYON (C. M.). *Piroplasmosis of Rhodesian Sheep, as observed, by Bevan.*—*Jl. Comp. Path. & Therapeutics.* 1915. Mar. Vol. 28. No. 1. pp. 60-61.

BEVAN has forwarded to the Wellcome Bureau of Scientific Research a number of blood films from a Rhodesian sheep which was suffering from both anaplasmosis and piroplasmosis.

That the parasites present were piroplasms and not organisms of the Theileria type was shown by the fact that no bodies resembling Koch's bodies were found in any of the internal organs. The parasites were, however, very variable in shape and some of them were very small. As none but local sheep were available for inoculation it is possible that the experimental inoculations carried out may not succeed, owing to the animals used having acquired some degree of immunity.

TRYPANOSOMIASIS.

- (59) LANFRANCHI (A.). *L'Oftalmo e l'Intrapalpebro-reazione nella Diagnosi e nella Differenziazione di Alcune Tripanosomiasi. Nota Preventiva.* [The Ophthalmic and Intrapalpebral Reactions in the Diagnosis and Differential Diagnosis of the Trypanosomiases. Preliminary Note.]—*Il Moderno Zooiatro.* Parte Scientifica. 1915. Jan. 31. Vol. 36. No. 1. pp. 1-3. With 2 text-figs. and *Bull. Soc. Path. Exot.* 1915. Mar. Vol. 8. No. 3. pp. 112-115.

In this paper the author briefly records some observations regarding the diagnosis of trypanosomiasis by means of the ophthalmic and the intrapalpebral tests, using extracts of trypanosomes derived from rats. The trypanosomes used in the experiments were the trypanosome of surra and *T. brucei*. The extracts were made with glycerin, alcohol, ether, chloroform, and distilled water, following LEVADITI's technique.

The conclusions are as follows :—

It was possible with a glycerin or an alcoholic extract of the infecting trypanosome not only to arrive at a diagnosis of surra in the dog, but to distinguish the infection from nagana.

In the horse it was possible to obtain similar results with these extracts, both by the ophthalmic and the intrapalpebral methods.

The author intends to examine the question as to whether during afebrile periods a diagnostic elevation of temperature can be obtained by the intrapalpebral test.

- (60) WEBB (E. Clive). Trypanosomiasis of Donkeys and Mules in the Anglo-Egyptian Sudan.—*Jl. Comp. Path. & Therapeutics.* 1915. Mar. Vol. 28. No. 1. pp. 1-20.

The common trypanosome of the mule and the donkey in the Sudan is a polymorphic one, and the author thinks that it is identical with the polymorphic *T. brucei*. Brief details are given of a number of experimental inoculations carried out both with mule and donkey trypanosomes upon a variety of species of animals.

The paper also includes an account of the treatment with atoxyl and arsenic adopted in the case of a number of diseased mules and donkeys. The general lines followed were those laid down by HOLMES for the treatment of surra.

The total number of animals submitted to treatment was 22. Of these 12 died and 10 recovered.

The results obtained are not so favourable as those obtained by HOLMES, but provided the cures are permanent they are not unsatisfactory. It is pointed out that the great majority of animals were in very poor condition when the treatment was started and some of them were actually in extremis.

In treating the animals the dosage was severe, the treatment being pushed to a dangerous extent ; one of the reasons for this being that any treatment which is to be economically practicable must be of short duration. Owing to a shortage of atoxyl, treatment with arsenic was adopted as far as possible, and in five instances death was actually due to or hastened by arsenical poisoning.

- (61) AUBERT (P.) & MICHELI (M.). Essais de traitement des infections expérimentales à *Trypanosoma gambiense* et *dimorphon* avec des "Suspensions huileuses d'Arsenic et d'Antimoine" (Métoléine). Note préliminaire. [Experiments regarding the Treatment of Animals infected with *T. gambiense* and *T. dimorphon* by Means of Arsenic and Antimony suspended in Oil (Metoleine). Preliminary Note.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 28-30.

The name Metoleine has been given by DEGUY and LESURE to suspensions in oil of finely divided metals or metalloids. The arsenic metoleine contains 8 per cent. of arsenic and the antimony metoleine 20 per cent. of antimony. The oily excipient contains 11·75 per cent. of anhydrous lanoline and 88·25 per cent. of vaseline oil.

The authors have carried out a small number of experiments with guinea-pigs experimentally infected with *T. gambiense* and *T. dimorphon*.

The drugs were administered in doses ranging from $1/10 - 3/10$ cc. by intramuscular injection, and no evidence of reaction was observed at the seat of injection. Both the suspensions appeared to exercise a distinct trypanocidal effect.

The metals are absorbed very slowly and also very slowly eliminated.

- (62) LAVERAN (A.). Le dérivé O₁ du Diaminoarsénobenzène dans les trypanosomiases du chien et du cobaye. [The O₁ Derivative of Diaminoarsenobenzene in the Treatment of Trypanosomiasis of the Dog and the Guinea-pig.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 31-32.

Five dogs infected with *T. gambiense*, *T. congolense*, and *T. soudanense* were treated by intravenous injections of O₁ in doses of 2 to 3 cg. per kilogramme. Of the three dogs infected with *T. congolense* two appeared to have made a complete recovery after 6 or 8 injections. In the two dogs inoculated with *T. gambiense* and *T. soudanense* only a temporary improvement was noted, a fatal termination occurring in both cases.

Possibly the results were not as good as they might have been owing to the fact that only 2 cg. per kilogramme were given at first, whereas 3 cg. is borne quite well by the dog.

Experiments with guinea-pigs failed owing to the production of very severe lesions at the seat of injection when the drug was administered intramuscularly.

In one instance, however, a remarkable result was obtained. A guinea-pig inoculated with an atoxyl-resistant strain of *T. gambiense* was given an injection (method not stated) of 5 cg. of O₁. The trypanosomes disappeared from the circulation in 24 hours. Four further injections of 4 to 5 cg. were given and trypanosomes did not reappear in the blood until the 57th day after the first injection. The guinea-pig died five days later after giving birth to five dead young.

- (63) MESNIL (F.) & MOTAIS (F.). Sur l'action trypanocide *in vivo* d'un dérivé (OK₁) du diaminoarsénobenzène. [The Trypanocidal Action *in vivo* of OK₁, a Derivative of Arsenobenzene.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 32-34.

In this short paper the author publishes the incomplete results of some experiments which were interrupted in August 1914.

* OK₁ is a yellowish powder which is very stable when exposed to the air, is easily soluble in water, and when in solution does not rapidly undergo any alteration. Subtoxic doses when injected subcutaneously are well borne.

By experiment it was found that the toxic dose for a mouse weighing 20 grammes was 0·60 cg. The therapeutic dose for a mouse of this size was therefore fixed at 0·3 cg. Three mice infected with nagana and six with *T. gambiense* were subjected to treatment, and recovery occurred in every instance. Exactly similar results were obtained with arsenophenylglycin administered in the same dose.

In every case trypanosomes were numerous in the blood when the treatment was resorted to, and disappeared from the blood within 36 hours. With arsenophenylglycin this disappearance occurred rather more rapidly.

As rats are, in the opinion of the authors, more difficult to cure than mice, two series of experiments were undertaken with this species. The trypanosome used was *T. gambiense*, and the strain used caused a fatal result in mice in 7 days.

The dose used was the same as for mice, i.e., 0·3 cg. per 20 grammes.

In the first series a few of the rats died of intoxication within a few days of the administration of the drug, but those that survived showed no relapse for a period of a month after.

In the second series some of the rats were treated with arsenophenylglycin, and save in one instance the results were exactly the same.

It is admitted that a month is not a sufficiently long period to allow of a definite opinion as to the permanency of the cure, but it is considered to be sufficiently long to permit the conclusion to be drawn that OK₁ is not inferior to arsenophenylglycin in its trypanocidal action. It is superior to that drug in its stability.

- (64) LAFONT (A.) & DUPONT (V.). Action comparée, *in vivo*, chez le rat blanc, de l'atoxyl du salvarsan, du néosalvarsan, du garyl et du ludyl sur *T. gambiense* et *Tr. rhodesiense*. [The Comparative Actions of Atoxyl, Salvarsan, Neosalvarsan, Garyl and Ludyl upon White Rats infected with *T. gambiense* and *T. rhodesiense*.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 37-46.

The conclusions based upon the experiments detailed in this paper may be summarised as follows :—

1. In doses of 0·15 eg. per kilogramme, salvarsan, neosalvarsan, and ludyl do not lead to any diminution in the number of parasites present in the blood, while, on the other hand, a single injection of the same dose of garyl causes a complete disappearance in from 4 to 8 days.
2. While the duration of life in rats infected with *T. gambiense* is on an average 12 days, ludyl and neosalvarsan in the dose mentioned do not cause any change in this period. In rats treated with salvarsan the average period is 18 days, and in those treated with garyl 22 days.

- (65) SEIDELIN (H.). Experiments with Salvarsan-Copper in Trypanosomiasis.—*Ann. Trop. Med. & Parasit.* 1915. Mar. Vol. 9. No. 1. pp. 197-200.

The author has carried out a small number of experiments with a salvarsan-copper compound named K₃ obtained from EHRLICH, using rats experimentally infected with a trypanosome of the *T. brucei* group, which had been maintained for some time in rats and guinea-pigs, and proved fatal to the latter species in eight to seventeen days after intraperitoneal inoculation.

It was found that a dose of 0·0064 g. failed to effect a permanent cure in rats weighing 60 grammes, and with this dose areas of necrosis at the seat of inoculation were produced in some cases and in others death resulted.

- (66) DUKE (H. L.). The Wild Game and Human Trypanosomiasis ; with some Remarks on the Nomenclature of Certain Pan-African Trypanosomes.—*Jl. Trop. Med. & Hyg.* 1915. Jan. 15. Vol. 18. No. 2. pp. 13-16.

In this paper reference is first made to the trypanosomes occurring in man. The features of these parasites to which attention is drawn are the following : *T. gambiense* is insusceptible to the action of human serum, it causes a chronic disease in cattle, sheep and goats,

and runs a relatively chronic course in dogs and small laboratory animals. *T. rhodesiense* on the other hand is susceptible to the action of human serum, and produces a more acute infection both in man and in animals. Neither of the trypanosomes causes disease in wild animals.

Proof has been furnished of the part played by game as a reservoir for *T. gambiense* by the fact that two fly boys employed by CARPENTER have contracted the infection after a residence of 18 and 33 months on the lake shore, and this at an interval of five years after the removal of the inhabitants.

The facts with regard to the other trypanosome causing disease in man—*T. rhodesiense*—are different. There has never been anything like the loss of life caused by this organism that there has been by *T. gambiense*, and eminent English observers are of the opinion that the evidence indicates that *T. rhodesiense* and the polymorphic trypanosomes showing posterior nuclear forms occurring in game are identical.

In addition to these polymorphic trypanosomes there are two easily recognised types which have a very wide distribution. These are the *T. vivax*, and the *T. congolense-nanum (pecorum)* groups.

During their development in *Glossina* these three groups behave in different ways. In the *vivax* group only the proboscis of the fly is invaded; in the *congolense* group the gut and the proboscis are involved; and in the polymorphic group development takes place in the gut and the salivary glands.

The majority of mammalian trypanosomes occurring in Africa can be placed in one or other of these groups, and in the author's view difficulties arise when attempts are made to get further subdivisions, owing to the unnatural way in which the finer tests are carried out. Emphasis is laid upon the part played by the transmitting flies, and upon the inadvisability of founding any conclusions upon the study of strains that have been maintained exclusively by means of the syringe.

According to Miss ROBERTSON the morphological changes observed in the polymorphic strains indicate definite phases of development of the trypanosomes in the mammalian host. The short form is believed to be especially connected with the infection of the fly, because when the proportion of short forms is high a high percentage of positive flies fed upon such blood is obtained.

Another example of the confusion that has arisen owing to insufficient attention being paid to natural conditions is given in connection with *T. nanum* and *T. congolense (pecorum)*. Originally the strains were distinguishable by their action on the dog and also by the different degree of pathogenicity possessed by them for domesticated ruminants. Upkeep of these strains in the laboratory has gradually eliminated these characteristics.

The suggestion is put forward that all these polymorphic trypanosomes, excluding *T. gambiense*, should be looked upon as one species having its anterior seat of development in the fly in the salivary glands, primarily a parasite of wild game, and too pathogenic for domesticated animals for these to be the principal hosts. *T. gambiense* is mainly distinguished from the other polymorphic strains by its unfailing pathogenicity for man.

With regard to the nomenclature of these parasites the author suggests that they should all be termed *T. brucei*, and he does not consider that *T. rhodesiense* should stand as a good species until it has been proved that the power of infecting man can be maintained through the fly, and that man can be infected from man.

- (67) DELANOË (P.). Au sujet des trypanosomes du type *T. lewisi* Kent rencontrés chez des Muridés dans la région de Bouaké (Côte d'Ivoire). [The Occurrence of Trypanosomes of the *lewisi* Type in the Muridae encountered in the Bouaké District of the Ivory Coast.]—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 80-88. With three groups of text-figs.

In 7 out of 53 striped rats belonging to the varieties *Arvicanthis barbarus* and *Arvicanthis barbarus pulchellus* the author has discovered trypanosomes of the *lewisi* type. In five of these animals the parasites were numerous in the blood. Morphologically the trypanosome appears to resemble *T. lewisi* very closely. No lesions were found in the bodies of rats killed when parasites were present in the blood in large numbers.

Adult white rats appear to offer a very high degree of immunity to inoculation with this trypanosome, but it would seem that young white rats can be infected by intraperitoneal inoculation. Two out of three grey rats became infected.

A guinea-pig and some mice failed to become infected, but two young specimens of *Golunda campanae* Huet (a small rodent somewhat resembling the jerboa) became infected and recovered. Owing to the lack of details the author is unable to say whether this trypanosome is identical with that described by WENYON as occurring in the striped mouse in the Soudan.

Trypanosomes of the *lewisi* type were found in 9 out of 66 specimens of *Mus concha* Smith examined. To this parasite the author has given the name *T. eburneense*. As in the case of the previous trypanosomes, the infected animals were caught during both the dry and the rainy seasons. In eight instances the blood was swarming with trypanosomes.

Measurement of 36 parasites appeared to indicate that it is rather longer than *T. lewisi*, and the author believes that the trypanosome is pathogenic, as in two out of four cases rodents of the same species inoculated intraperitoneally died in 25 and 33 days respectively.

Golunda campanae, which has not been found to be naturally infected, is very susceptible to inoculation, while three striped rats failed to become infected. The white rats appear to be refractory, and in the guinea-pig intraperitoneal inoculation leads to a limited multiplication of the parasites in the peritoneal cavity only. *Xerus erythropus* is susceptible, but recovery confers immunity.

A third trypanosome, to which the author gives the name *T. quis'hari*, has been found in savannah rats. Sixteen were found to be infected out of 128 examined. In every instance the parasites were very scantily present in the blood.

The trypanosome ranges from 42 to 47 microns in length.

Young savannah rats, striped rats, *Golunda campanae*, and white rats all resist inoculation.

- (68) VIALATTE (C.). Au sujet d'un trypanosome du chien observé dans le Sahara Oranais. [A Trypanosome of the Dog discovered in the Oran District of the Sahara.]—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 70-72.

The animal in which the trypanosome was discovered showed a train of symptoms similar to those generally encountered in cases of trypanosomiasis, and in the later stages there was paralysis of the hind quarters. Examination of the blood on a number of occasions showed that the parasite was sometimes numerously present, sometimes in small numbers, and sometimes quite absent.

The trypanosome ranged from 17 to 24 microns in length and from 1.5 to 2 in width. The free portion of the flagellum measured from 3.5 to 5 microns. The posterior extremity of the body was always more or less obtuse, and granules were frequently present in the anterior half of the body.

Experiments are being carried out with the object of identifying the parasite if possible, but the author appears to incline to the view that the trypanosome closely resembles, at least from the morphological point of view, *T. soudanense* var. *berbera*.

- (69) SERGENT (Edm.), LHÉRITIER (A.) & LANDES (L.). Absence d'immunité héréditaire à l'égard du *Trypanosoma soudanense* chez un chèvreau né d'une chevre immunisée envers ce Trypanosome. [Absence of Immunity against *T. soudanense* in a Kid born of a Goat immunised against this Trypanosome.]—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 73-74.

The authors give the details of an experiment the results of which confirm those obtained by LAVERAN regarding the non-transmission of immunity from parent to offspring.

- (70) TERRY (B. T.). The Influence that Serum exerts upon Trypanosomes, with Special Reference to its Use for Experiments in vitro with Atoxyl and Paraminophenylarsenoxyd.—*Jl. Experim. Med.* 1915. Mar. 1. Vol. 21. No. 3. pp. 250-257.

The bulk of this paper comprises the results of observations made regarding the effects produced upon trypanosomes suspended in salt solutions and sera.

A number of experiments were made in which trypanosomes were suspended in normal salt solution, Ringer's solution made up according to the formulae of MELTZER and of CARREL, and serum derived from different species of animals. In every instance the parasites retained their motility better in the serum than in the other liquids, in which the results were rather variable on different occasions.

Further comparisons were made in which the tubes were kept in an ice chest instead of at room temperature as in the first experiments, and from these it was seen that vitality was retained for a longer time in tubes kept at room temperature than in those kept in the ice chest.

Experiments also showed that not only did the trypanosomes retain their motility and their normal staining reactions better in serum, but also that they retained their pathogenic powers better in the same liquid.

Before the effects of drugs could be tested in vitro it was essential that evidence should be obtained as to whether the serum would produce any alteration in the drugs after the manner of the changes produced by blood. The experiments carried out with this object showed that serum did not exert any actions upon the drugs comparable to those exerted by blood.

The author's conclusions may be summarised as follows :—

Serum preserves the motility of the trypanosome of nagana better than salt solution, and it is preferable to use the serum undiluted. The filtration of the serum through a Berkefeld filter and the storing of it for months in an ice chest does not cause any change in it in this respect.

The vitality of the trypanosomes was preserved better at room temperature than at the temperature of an ice chest, and trypanosomes preserved in serum at room temperature for eight days were capable of infecting experimental animals. Serum does not convert atoxyl into a toxic substance when incubated with it, nor does it bind paraminophenylarsenoxyd.

- (71) BROWN (Wade H.). Concerning Changes in the Biological Properties of *Trypanosoma lewisi* produced by Experimental Means, with Especial Reference to Virulence.—*Jl. Experim. Med.* 1915. Apr. Vol. 21. No. 4, pp. 345-364.

The investigations detailed in this paper were carried out in the course of an inquiry into the possible causes of exalted virulence of *T. lewisi* for the rat, regarding which the author published a paper in 1914 (see this *Bulletin* 1914. Sept. Vol. 2. No. 3, p. 130).

In the instance of exalted virulence recorded in the above paper the indications were that either the method of passage adopted or the character of the rats used, or both of these factors, played some part in the causation of the change.

Four groups of experiments were carried out with the object of ascertaining whether these factors had any determining influence on the point, and two strains of the trypanosome, viz., the so-called pathogenic strain, and a recently isolated strain were used in each case.

In the first series of experiments the animals used were for the most part large, and the inoculations were the ordinary stock transfers. The rate of passage in this series was irregular and slow, and the inoculations were intraperitoneal, two drops of infective blood mixed with 0.5 cc. of salt solution being injected.

In the second series the method of inoculation was the same, but the inoculations were made as nearly as possible at the height of the multiplication of the parasites. Large rats were again used.

In the third series the conditions of the second series were repeated, with the exception that small rats were used in the place of large ones.

In the fourth series, which was a control series, the rats were inoculated in pairs, and at the height of the multiplication of the trypanosomes one of each pair was killed and its blood was used for the inoculation of a fresh pair.

The whole of the results obtained are set out in the form of tables, and the changes produced are grouped under various headings.

In connection with the cycle of infection it was found that when successive inoculations were made at short intervals the tendency was for the period of incubation to become shorter. Special attention is directed to the distinction that must be drawn between true and false incubation, the latter being the appearance of trypanosomes in the blood within a few hours after inoculation when large numbers of trypanosomes are used for infection. It was further found that rapid passage tended to shorten the period between the first appearance of the parasites in the blood and their maximum degree of multiplication. In some instances also it was observed that the duration of the infection tended to become shorter when rapid passage was practised.

The degree of virulence of the trypanosomes in the various groups as judged by the severity of symptoms produced and the number of deaths occurring serially and not in individuals appeared to show that there was a cycle of change. A similar result was obtained with the rats inoculated with blood taken at different stages of infection. This was particularly the case with the pathogenic strain.

The changes in morphology have been described in the previous paper, but it is here pointed out that alterations in morphology were mainly encountered in infections of considerable severity.

In addition to the foregoing experiments a further investigation was started in which the passages were effected when rats appeared to be on the point of recovery. The series could not be completed owing to the failure of the infections after a few generations, but certain results suggested that in such cases the infections might fail owing to the transference of a large quantity of immune bodies and a small number of trypanosomes.

The results obtained are discussed at some length and the following summary is drawn up :—

" 1. Different strains of *Trypanosoma lewisi* represent different states of biological balance, especially between the powers of propagation and resistance to destruction.

" 2. The biological status of a given strain of *Trypanosoma lewisi* is subject to cyclic variations as the result of immunological reactions in the blood of the host.

" 3. The factors limiting reproduction and causing destruction of *Trypanosoma lewisi* in the blood are appreciably independent of each other. It is possible, therefore, to influence these processes separately and even in opposite directions.

" 4. The virulence of *Trypanosoma lewisi*, manifested in its highest form, is dependent upon some degree of reproductive fastness, strong antigenic action, and susceptibility to destruction, varying degrees in the development of these properties producing corresponding variations in the degree of virulence.

" 5. By a properly regulated system of passage the properties of *Trypanosoma lewisi* that determine its infection cycle and its virulence may be eventually so altered as to change completely both the nature and course of the infection. Such a system of passage must be adapted to the particular strain of *Trypanosoma lewisi* used.

" 6. Immunological reactions exercise a dominant influence in determining the ultimate biological variations of *Trypanosoma lewisi*."

(72) CARINI (A.) & MACIEL (J.). Sur un hémogregarine et un trypanosome d'un muridé (*Akodon fuliginosus*). [A Haemogregarine and a Trypanosome of *Akodon fuliginosus*.]—Bull. Soc. Path. Exot. 1915. Apr. 15. Vol. 8. No. 4. pp. 165-169. With 2 text-figs.

(Leuco-) *Haemogregarina akodoni*.—The rats in which this parasite

was found showed no evidence of ill health even when considerable numbers of them were present in the blood. The parasites were oval in shape measuring 10 by 3·5 microns. The majority of the organisms seen were within large mononuclear leucocytes applied closely to the side of the nucleus. They possessed a hyalin cytoplasm and an oval granular nucleus. All the parasites appeared to be at the same stage of development and in none of them could a micronucleus be detected. Free forms in fresh preparations appeared to execute slow vermicular movements.

Trypanosoma akodonii.—In addition to the haemogregarines trypanosomes were also found in the blood of some of the rats examined. They were not numerous, but they could be found in every preparation made.

In the living state they were very actively motile. In stained preparations it was seen that the blepharoplast, which was situated close to the posterior extremity, was large and oval in shape, and was placed transversely in the body. The nucleus was placed about the middle point of the body, and the undulating membrane was well developed and showed two or three folds. The parasite appeared to resemble *T. cruzi*. It apparently failed to infect guinea-pigs and kittens which were inoculated by the authors.

Some laboratory bred larvae of *Triatoma infestans* were fed with blood containing the trypanosome, but no flagellates could be found in their intestinal contents.

- (73) OUZILLEAU (F.). Rapport d'ensemble sur la maladie du sommeil dans le Bas-M'Bomou (1912-1913). [Report on Sleeping Sickness in Lower M'Bomou.]—*Bull. Soc. Path. Exot.* 1915. Mar. Vol. 8. No. 3. pp. 138-154 & Apr. Vol. 8. No. 4. pp. 178-198.

This report contains a few lines regarding the trypanosomes encountered in animals in the district (pp. 197-198).

There are only two herds of cattle in the district, each of which numbers about 30 animals, and there are very few horses and donkeys. All the animals come from the Anglo-Egyptian Soudan.

No cases of trypanosomiasis in the horse have been encountered by the author. *Trypanosoma pecaudi* has been seen in cattle, and on one occasion an outbreak caused by this parasite resulted in the death of ten out of thirty animals. A number of the cattle harboured the parasite without showing any clinical symptoms.

The same trypanosome was discovered at Bangassou in some donkeys which had been imported from Bahr-el-Ghazal.

- (74) MINCHIN (E. A.) & THOMSON (J. D.). The Rat Trypanosome, *Trypanosoma lewisi*, in its Relation to the Rat Flea, *Ceratophyllus fasciatus*.—*Quart. Jl. Microscop. Sci.* 1915. Jan. Vol. 60. No. 4. pp. 463-602. With 20 plates and 24 text-figs.

This monograph is divided into the following three parts :—

I. Notes on the flea, anatomy, methods of dissection, parasites of the flea, histological structure of the stomach, and technique.

II. Development of *T. lewisi* in the flea, (a) the stomach phase, (b) migration to the rectum, (c) rectal phase.

III. Experimental study of the problems of transmission and development.

In the first section full details of the methods adopted for the dissection of the fleas and of the anatomical structure of the organs are given.

Special attention is drawn to the fact that the authors' fleas were free during the whole of their experiments from flagellate parasites other than that with which they were working, and a summary of the evidence establishing this point is given.

The authors deal at considerable length with the technique adopted in the preparation of permanent specimens, both smears and sections.

In the second portion of the paper the development of *T. lewisi* in the rat flea is dealt with, and the following is a condensed account of the cycle.

Fleas which have been fed upon infected rats are not again infective for susceptible rats until a period of six days has elapsed, as the stumpy form of trypanosome which represents the final stage of development in the flea does not make its appearance in the rectum until the fifth day after the infecting meal.

Except for the occurrence of small crithidial forms in the Malpighian tubes the entire cycle of development is carried through in the alimentary canal. There is no invasion of the salivary glands.

The cycle of development can be divided into two more or less sharply defined phases, viz., a stomach and rectal phase.

The stomach phase is generally short, amounting only to 24-48 hours, but occasionally longer. During this phase the trypanosomes penetrate the epithelial cells of the stomach lining and undergo a process of multiple division.

In the intestine the trypanosomes do not come to rest, but merely pass through on their way to the rectum.

The rectal phase consists of small individuals which are crithidial in structure, and are attached by the end of the flagellum to the wall of the gut. In this position repeated binary fission occurs. This phase appears to continue as long as the flea remains alive. By modification the crithidial forms give rise to trypanosome forms by which the infection of the rat is brought about.

It is only about 25 per cent. of fleas that show these phases of development of the trypanosomes, in the remainder the trypanosomes ingested appear to die out, and consequently it is necessary to recognise those forms which represent degenerative changes. A great deal of information upon this point was gained by the authors through the examination of fleas at given intervals after feeding.

In the phases of normal development of the trypanosomes in the stomach the following stages in the process of multiplication can be established from the examination of smears and sections and of living preparations :—

1. Trypanosomes of ordinary appearance which seem to have recently penetrated into the epithelial cells.

2. Flat-end pear-shaped forms which are produced by a doubling of the body upon itself.

3. Rounded or oval forms which are produced from the pear-shaped forms by a further rolling or doubling up of the body. There are

apparently no leishmania-like forms without any flagellum. In these rounded forms process of multiplication can be seen. The division of the various structures goes on much as in ordinary trypanosomes. The flagellum does not split, but the daughter parasites are provided with new flagella which grow out from the daughter kineto-nuclei.

4. The final stage of intracellular multiplication is represented by the "sphere" stage. In this stage the parasites form large rounded masses in the epithelial cells. The invasion of any cell may be single or multiple, and the parasites are in a state of constant movement within the host cell. Some of these spheres show a "tail" composed of flagella and others are "tailless." In the latter the flagella are wrapped round the body. Finally the mass separates into a number of individuals which are set free by the rupture of the cell containing them. The number of individuals produced varies, but in many instances eight were observed.

The parasites produced in this way are crithidiomorphic, the nuclei being more or less closely placed to each other, and they are very long.

It cannot be stated how long this process of multiplication requires for its completion, nor can it be stated how many times it may be repeated.

The crithidiomorphic parasites pass straight through the intestine, and by the time that they reach the rectum the posterior extremity has generally become club-shaped.

In the rectal phase the parasite loses its very marked activity and becomes sluggish. It also shows a great tendency to adhere to debris, cells, and even to the cover-glass by means of its flagellum. The body becomes shortened and changes its shape owing to a concentration of the cytoplasm towards the posterior extremity of the body. The flagellum also becomes shortened. The kineto-nucleus takes up a position beside or in front of the tropho-nucleus, and then the parasites multiply by division. The order given does not of necessity indicate their chronological succession, but it is established that no multiple division occurs in the rectum, and also that there is no intracellular stage.

In the fully established rectal phase the parasites are all small crithidial forms, many of which are attached to the epithelial cells by their flagella. This phase is rarely established less than 36 hours after the infective feed. Multiplication of these forms in the rectum probably continues as long as the flea lives, but a proportion of the parasites become developed into stumpy trypaniform individuals which represent the final propagative phase, and at this stage the development in the rat comes to a stop.

Degenerative changes. Degenerating trypanosomes are most abundantly present in fleas examined during the first 24 hours after feeding, and they have generally quite disappeared within 36 hours, but they may sometimes be found later. The parasites either begin to degenerate immediately after they are taken up by the flea, or they may develop to a certain extent and then undergo degenerative changes. It is organisms that have proceeded to a certain stage of development before undergoing degeneration that account for the late degenerative changes observed.

The principal feature which marks degeneration is a progressive diminution in size, the shrinkage commencing at the flagellar end and

extending backwards. Degenerating forms show a great tendency to form clumps, but these clumps are distinguishable from the true agglomerations in that the parasites attach themselves to each other by the flagellar ends. In the final stage the parasites are very small, and they simply represent the hinder ends of the original trypanosomes. Among the degenerative forms in the rectum recurved forms similar to those normally occurring in the stomach are sometimes found.

The authors have never been able to find any evidence that there is a sexual stage in the development of *T. lewisi*.

In Part III. of the paper are discussed the experimental studies of the problems of transmission and development.

After dealing with the technique employed in the care and handling of the rats and fleas, the authors proceed to a discussion of the general problems.

It is held by the authors that the following facts have been established by experiment :—

Trypanosoma lewisi is transmitted from rat to rat by the rat-flea, *Ceratophyllus fasciatus*, and the transmission takes place by the cyclical method only. In a rat infected through the agency of fleas the trypanosomes appear in the blood on the fifth to the seventh day after infection, and multiplication of the parasite in the blood of the rat comes to an end 11 to 13 days after infection. In the flea the parasite requires a period of not less than five days for the completion of its cycle, and fleas are never infective until that cycle is completed. The infection of the rat is brought about through the medium of the small trypanosome-form which is the final stage of development in the flea and which takes place first in the rectum but may subsequently occur in the stomach also. The whole of the cycle of development goes on in the alimentary tract, and no other part of the flea is invaded by the trypanosome in any stage of its development. Once a flea has become infective it remains so for a long time. The rat becomes infected through ingesting either the moist faeces of infective fleas or the fleas themselves, and the authors' experiments indicate that the flea cannot infect rats through the medium of the proboscis. No evidence was obtained that the trypanosome is passed from flea to flea in an hereditary manner. Only a small proportion of the fleas which have access to infection become infective.

The starvation of fleas during the incubative period does not hinder the cycle of development in the flea.

LEISHMANIASIS.

- (75) SERGENT (Edm.). *Infections expérimentales de la souris par des cultures de la Leishmania tropica*. [The Experimental Infection of Mice with Cultures of *Leishmania tropica*.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 22-25.

The author gives details of six experiments in which mice were inoculated either intravenously or intraperitoneally with cultures of *L. tropica* which he had isolated about a year previously from a case of oriental boil at Biskra. The mice were killed four months after inoculation. None showed any skin lesions, but in five of them there

was found to be a generalised infection, and the remaining one was healthy. The parasites were discoverable both by microscopic examination and by cultivation.

The results obtained by other observers are briefly summarised and the conclusion is drawn that up to the present there is so much divergence that no definite opinion regarding the identity of the various strains of Leishmania can be expressed.

- (76) LAVERAN (A.). *Les Leishmanioses chez les Animaux.* [Leishmaniasis in Animals.]—*Ann. Inst. Pasteur.* 1915. Jan. Vol. 29. No. 1. pp. 1-21,* and Feb., No. 2. pp. 71-104. With 2 plates and 2 figs.

iii. Experimental infections produced in different species of animals by *Leishmania donovani*—

It can no longer be held that Mediterranean and Indian kala azar differ from each other in regard to their inoculability into experimental animals, and particularly the dog and the monkey. The fact remains, however, that while the disease occurs as an enzootic among dogs in countries where the Mediterranean disease exists, all efforts to discover centres of canine leishmaniasis in India have, up to the present, failed. It has been found possible to infect dogs and other animals with the Indian disease provided a sufficiently large dose of infective material be given, but the evidence appears to show that the parasite is incapable of developing in *Ctenocephalus felis*, the common dog flea in India.

The paper contains somewhat lengthy summaries of experiments carried out by different observers, including the author, with regard to the infection of dogs, monkeys, flying foxes, mice, and rats, and reference is made to the negative results following the inoculation of guinea-pigs, rabbits, cats, and other animals.

Summarising the results obtained, the author draws attention to the following facts. *L. donovani* and *L. infantum* are both inoculable for the dog, certain species of monkeys, the white mouse, and with less certainty the rat, but the dog is less susceptible to the Indian disease than to the Mediterranean, or to the true canine infection. In addition to the fact that natural infection in the dog has not been observed in India in areas where the disease is endemic in man, is the further fact that it has been found possible to set up lesions in *Macacus* monkeys with the Indian virus, while attempts to infect the same species with *L. infantum* have so far failed.

A point which suggests the identity of the two diseases, while not furnishing absolute evidence, is that a *Macacus cynomolgus* which had acquired immunity against the Mediterranean disease failed to become infected with the Indian strain, while a control monkey contracted an infection which rapidly proved fatal.

iv. Natural and Experimental infections produced in different species of animals by *L. tropica*—

A summary is given of the recorded cases of cutaneous leishmaniasis in the dog, from which it appears that the condition is not common.

* For abstracts of previous portions of this paper see this *Bulletin*. Vol. 3. No. 1, pp. 19-20.

Some of the facts seem to suggest that one or more species of parasite different from *L. tropica* may be responsible for such lesions.

Experiments are cited to show that the dog, cat, monkeys of various species, mice, rat, guinea-pig, dormouse and merion can be successfully infected with *L. tropica*.

Among the animals in which no successes have been obtained are, the donkey, horse, goat, sheep, rabbit, sparrow, pigeon, and certain lizards.

The general conclusions drawn may be summarised as follows:—The parasite responsible for the disease in dogs cannot be distinguished morphologically from *L. infantum*, and clinically the natural disease of the dog closely resembles the condition set up in that species by inoculation with *L. infantum*. And, while there are still some points that require elucidation, the probabilities appear to be in favour of the view that the two parasites are identical.

With regard to the identity of the Mediterranean and the Indian diseases, it cannot be objected that animals that are susceptible to the one are refractory to the other, but dogs are certainly less susceptible to the Indian than to the Mediterranean infection, and, while it has been found possible to produce cutaneous lesions in monkeys with *L. donovani*, all attempts to produce similar lesions with *L. infantum* have so far failed. The unique experiments in which a cynomolgus monkey which was immune to the Mediterranean disease failed to become infected when inoculated with the Indian virus furnished valuable evidence regarding the identity of the two conditions.

With regard to the production of cutaneous lesions in animals with *L. tropica*, the question is put whether *L. tropica* may not be a variety of *L. donovani* or *L. infantum*, which has become adapted to certain conditions of existence or transmission that are different in some way from those obtaining in the case of these two parasites.

- (77) LAFONT (A.) & HECKENROTH (F.). Un Cas de Leishmaniose canine à Dakar. [A Case of Canine Leishmaniasis at Dakar.]—*Bull. Soc. Path. Exot.* 1915. April 14. Vol. 8. No. 4. pp. 162–164.

The case recorded in this paper was observed in a native dog in French West Africa.

The animal was in very poor condition and was affected with mange. Numerous other ectoparasites were also found. At the post-mortem examination the liver was found to be enlarged and pale in colour, and the spleen was also enlarged. There were numerous tubercles in the lungs in which acid-fast bacilli were found. Smears from the spleen and liver showed the presence of numerous Leishmaniae, especially those made from the former. The bulk of the parasites were free, but macrophages and liver cells were both found containing them. In the liver smears there were also found cyst-like forms which appeared to be in a stage of multiplication. These cysts measured from 15 to 20 microns and contained from 2 to 10 parasites. The appearances of those in which only two or three were found suggested that some of the individuals had escaped from the cyst. The parasites are said to have closely resembled *Leishmania infantum*.

- (78) DI CRISTINA (G.) & CARONIA (C.). Sulla Terapia della Leishmaniosi Interna. [The Treatment of Internal Leishmaniosis.]—*Pathologica*. 1915. Feb. 15. Vol. 7. No. 151. pp. 82-83.

The authors state that they have had satisfactory results from the intravenous injection of antimony tartrate, the drug being used in a 1 per cent. solution and given on alternate days, commencing with a dose of 2 eg. and increasing to 10 eg.

- (79) GIUGNI (F.). Sulla presenza della *Leishmania donovani* e sul suo sviluppo culturale dal sangue periferico nel Kala-azar. [The Presence of *Leishmania donovani* in the Peripheral Blood and its Cultivation from it.]—*Malaria e Malatt. d. Paesi Caldi*. 1915. Feb. 20. Vol. 6. No. 1. pp. 16-20.

The author records three cases in which the parasites could be detected by microscopic examination of the blood, but all attempts to obtain cultures from the peripheral blood failed.

- (80) PAVONI (G.). Contributo allo Studio della Infezione Sperimentale del *Mus musculus* con *Leishmania tropica* e *infantum*. [The Experimental Infection of Mice with *Leishmania tropica* and *Leishmania infantum*.]—*Pathologica*. 1915. March 1. Vol. 7. No. 152. pp. 114-116.

The author records the successful inoculation of mice with *L. tropica* and *L. infantum* by intraperitoneal and intravenous methods, but he has failed with subcutaneous inoculation. Thirty-two positive results were obtained with *L. infantum* and six with *L. tropica*. In a small number of cases lesions developed in connection with the skin after the lapse of some weeks. At first there was merely swelling and oedema of the skin, but a few days later these swellings became ulcerated and necrotic. Parasites could be found in liquid obtained from the oedematous swellings.

In those mice which did not develop skin lesions there was observed after an interval of about three months loss of hair and enlargement of the liver and spleen. The parasites were discoverable in these organs.

The experiments shed some light upon the question of the identity of the parasites responsible for Indian kala azar, infantile kala azar, and oriental boil.

- (81) DA SILVA (P.). Expériences sur la transmission de la leishmaniose infantile par les Puces (*Pulex irritans*). [Experiments on the Transmission of Infantile Leishmaniasis by Fleas (*Pulex irritans*).]—*Arquiv. Inst. Bact. Camara Pestana*. 1915. Vol. 4. No. 3. pp. 261-267.

In this paper the author records his experiments, in which a number of fleas were made to suck blood from a child that was seriously affected with kala azar. The fleas were fed upon the author for a period of at least a fortnight before being used and their faeces were carefully examined for the presence of any parasites resembling *Leishmania*. Five of the fleas originally collected were rejected on account of the presence of parasites of this type in their dejecta.

The fleas were fixed to threads in a manner similar to that adopted by NÖLLER, but silk was used in the place of silver wire. They were allowed to suck as long as they wished and were then incubated at 22° C.

All the dejecta passed by the fleas were very carefully examined microscopically after staining with Giemsa, and the fleas were kept alive for periods sufficiently long to allow any cycle of development to take place.

Twenty-five fleas were used, but in no case were Leishmania found in their faeces whether these were passed during the periods when the fleas were placed on the child or during the intervals.

- (82) YAKIMOFF (W. L.) & SCHOCKOV (N. F.). *Leishmaniose cutanée (bouton d'Orient), au Turkestan russe.* [Cutaneous Leishmaniasis (Oriental Boil) in Russian Turkestan.]—*C. R. Soc. Biol.* 1915. March 19. Vol. 78. No. 5. pp. 107-109.

The authors find that there are two varieties of *L. tropica* responsible for cutaneous lesions in Turkestan. To these they give the distinguishing names "major" and "minor."

L. tropica major.—The majority of the parasites are large and spherical. The cytoplasm often contains vacuoles and the nucleus, which is composed of separate granules, stains somewhat faintly. The blepharoplast may be either rod-shaped, circular, or curved, and stains more intensely.

L. tropica minor.—This parasite is generally shaped like a rice grain, but round and oval forms occur. The cytoplasm is compact and stains deeply. In it there can sometimes be seen small black granules resembling those seen in malarial parasites. The nucleus is oval or round, and compact in structure. The blepharoplast is rod-shaped.

The large forms may measure 5·5 microns but the small ones do not exceed 4 microns in their greatest diameter.

The Brazilian form of the parasite has not been observed. A mouse inoculated intraperitoneally with material derived from a lesion contracted generalised leishmaniasis.

Good results have followed the dusting of the lesions with medicinal methylene blue.

A dog was seen which had one lesion on the neck and one on the back. In these parasites measuring 8 microns were found.

SPIROCHAETOSIS.

- (83) ZINSSER (H.), HOPKINS (J. G.) & GILBERT (Ruth). *Notes on the Cultivation of *Treponema pallidum*.*—*Jl. Experim. Med.* 1915. Mar. 1. Vol. 21. No. 3. pp. 213-220. With 1 plate.

The authors confine themselves in this paper to a discussion of methods employed after a strain of the organism has once been obtained in vitro, leaving for a future report the subject of obtaining primary cultures from rabbits inoculated intratesticularly from human sources.

The strain used in these experiments was first passed under great pressure through a Berkefeld N. filter which had been used before, and it so happened that the treponema came through without any

bacteria. To test filtration as a method of isolation 44 filtration experiments of duration varying from one minute to two hours were carried out, but in no case were spirochaetes obtained without accompanying bacteria. The authors believe that these experiments prove that an ultramicroscopic form of the spirochaetes does not exist. The first pure cultures were obtained by Noguchi's method, employing heated human ascitic fluid mixed with agar after the addition of fresh rabbit kidney, the medium being covered with sterile paraffin oil. Successes were also obtained in gelatinised horse, ox, or sheep serum with and without the addition of tissue. It was necessary for other investigations to obtain large quantities of culture in a fluid medium, and the most successful method devised was the following:—Fluid serum-agar was poured into 200 cc. flasks to a height of about an inch. Pieces of sterile tissue were introduced and the medium inoculated. When the agar had set it was covered with a mixture of either salt solution and heated ascitic fluid, or slightly acid broth and ascitic fluid, up to the neck of the flask. A few pieces of sterile tissue were floated in the liquid, and a layer of paraffin oil was placed on the top.

Large quantities of growth were obtained in the liquid in from 2 to 4 weeks. Subsequently it was found to be unnecessary to use any agar, and for 6 months the strain has been maintained in serum broth mixtures with sterile rabbit kidney.

A number of experiments induced the authors to use heated tissue in the place of fresh tissue for addition to the medium. This was tried after the tenth culture generation and good growths were obtained. Cultures have been obtained in media composed of slightly acid meat infusion broth with heated sheep serum, together with autoclaved rabbit kidney, liver, spleen, brain, lung, heart, and skeletal muscle. It was also found that the tissue could be replaced by living *Staphylococcus aureus*, *Micrococcus candidans*, or other organisms. Finally the same strain was successfully cultivated in a simple medium composed of meat juice as obtained in the preparation of broth after autoclaving without other additions.

The authors do not think that the organism could have been cultivated in these media immediately after isolation. The ease with which cultures were obtained led them to take steps to make certain that *Treponema pallidum* was in reality the organism cultivated. Inoculation of rabbits before attenuation occurred had unfortunately been omitted, but comparison with three strains obtained from NOGUCHI confirmed the identity.

The treponemata are obtained by first centrifuging slowly to precipitate the clumps of coagulated protein, and then at high speed to collect the organisms. The yield may be increased by triturating the coagula in a mortar and treating them separately.

Lung tissue and supra-renal tissue appear to have been especially favourable tissues to use.

- (84) WOLBACH (W. B.). On the Filterability and Biology of Spirochaetes.—*Amer. Jl. Trop. Dis. & Prevent Med.* 1915. Feb. Vol 2. No. 8. pp. 494-505. With 2 plates comprising 13 figs.

Spirochaeta duttoni.—In studying this parasite the author has employed the technique of which he published an account in the

Journal of Medical Research in 1914, and by means of which parasites can be stained in sections and their distribution accurately studied. The results obtained confirm those of MARCHOUX and COUVY, who worked with the spirochaete of the fowl in *Argas persicus*, in disproving that the granules found in the epithelial cells come from spirochaetes. The method also proves that spirochaetes migrate through all the tissues and the ova of ticks, and that all the phenomena of transmission can be explained by this fact alone. Coiled and "encysted" forms can be found in the muscular and connective tissues of ticks, but they probably have nothing to do with multiplication.

Since it was shown by TODD and WOLBACH that *S. duttoni* could be forced through a Berkefeld filter by a pressure of over 50 pounds to the square inch, the work in connection with the filterability of spirochaetes was carried on with free living spirochaetes—*S. elusa* and *S. biflexa*. *S. elusa* shows all the morphological characters presented by pathogenic spirochaetes including the coiled and "encysted" forms. All attempts to show that these latter forms had anything to do with reproduction or were even viable failed.

By repeated filtrations in series the author was able to get 100 per cent. of filtrates containing spirochaetes, the effect probably of a process of selection. By suitable technique he was also able to show the presence of spirochaetes in the thickness of the walls of the filter used. While repeated filtration increased the motility of the organism, direct subcultures gradually lost their power of movement.

The non-pathogenic spiral organisms isolated were capable of multiplying in and on artificial media with the production of visible colonies. On the other hand their morphological characters were very like those of the pathogenic spirochaetes and of *Treponema pallidum*.

TOXOPLASMOSIS.

- (85) LAYERAN (A.). *Nouvelle contribution à l'étude du Toxoplasma gondii.* [A Further Contribution to the Study of *Toxoplasma gondii*.]—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 58-63. With 1 text-fig.

In addition to the animals previously reported as having been proved susceptible to this parasite by experimental inoculation, the following have been successfully infected by the author:—dwarf mice, field mice, jerboa, and European dormice. Failure has followed the inoculation of small dormice (of Southern Europe and North Africa), a musk rat, and pigeon. Details of the various inoculations are given.

Attention is drawn to the fact that while mammals and birds can be successfully infected, closely allied animals such as the rat and the mouse, and the two kinds of dormice may be susceptible and insusceptible respectively. It is also stated that the parasite, which in 1913 was found to be of very low virulence for the pigeon, has completely lost its power of infecting that bird after numerous passages through the mouse.

Regarding the morphology of the parasite the author states that during his earlier observations on the parasite certain appearances were encountered which suggested that multiple division of the nucleus

took place. In preparations stained by the iron haematoxylin method groups of toxoplasms were found apparently enclosed in a cyst. Subsequent examinations showed that in reality these parasites were enclosed in cells the nuclei of which had not taken the stain. The author now expresses the view that in the multiplication of the parasite multiple division of the nucleus of the parasite does not take place.

Numerous preparations have been examined for the presence of a centrosome in the parasite, but none has been discovered. Nor has the author been able to see the least trace of a flagellum either in freshly obtained parasites or in parasites kept in a moist chamber for 48 hours.

A number of attempts to obtain artificial cultures have failed.

PROTOZOA.

- (86) WOODCOCK (H. M.) & LAPAGE (G.). *Observation on the Life-Cycle of a New Flagellate *Helkesimastix faecicola*, n. g., n. sp.: together with Remarks on the Question of Syngamy in the Trypanosomes.*—*Proc. Roy. Soc.* 1915. Feb. 1. Series B. Vol. 88. No. B 604. pp. 353-370. With 2 plates comprising 60 figs.

The flagellate described in this paper has been found in the faeces of the goat and sheep, and during its passage through the alimentary canal it appears to remain in an encysted condition. The cysts are spherical or ovoid, and measure about 3 microns in diameter. There is a distinct but not very thick wall which appears to be single. The protoplasm is homogeneous or finely granular, and the nucleus and sometimes a karyosome can be made out, but there is no vacuole. No division takes place within the cyst. In artificial cultures the cyst wall may disappear within about 22 hours and the parasite may become somewhat elongated after its disappearance. The wall does not rupture as is shown by the fact that no empty cyst is left behind when the parasite moves away. Excystment has only been observed in preparations in which aerobic bacilli were numerously present. The elongated parasite shows a minute contractile vacuole. Within a few minutes small jerky movements were seen, and a short flagellum projecting from about the middle of the body was observed. The parasite then increased somewhat in size, and the flagellum became longer and moved towards the anterior end of the body. Within about 20 minutes short gliding movements were observed and in an hour the parasite was seen to glide steadily out of the field of vision.

In the meantime the protoplasm had become granular and the nucleus could not be made out.

The active individual is described as being shaped rather like a carrot and measuring 6 to 7 microns in length by 2 to 2.5 in width. The single flagellum is two to three times the length of the body, is always directed backwards, and is dorsal in position. There is no centrosome.

Two types of movement are exhibited. One is seen when the organism glides along the surface of fluid, during which the only movements of the organism itself are slight jerky motions from side

to side made by the anterior end. Possibly surface tension plays some part in the production of this type of movement. When an individual is in the depths of a liquid medium undulating movements of the body and the flagellum are made.

After remaining active for some hours multiplication commences. An individual that is about to divide comes to rest and acquires a rounded shape, the flagellum being apparently lost. At this stage two karyosomes can often be seen in the nucleus. In a few minutes the body becomes elongated and then dumb-bell shaped and the nucleus divides, one part going into each end. About this time two new flagella appear, one towards each end and at opposite sides of the body. Ultimately the two parts separate from each other. The whole process takes from 15 to 30 minutes. In cultures multiplication goes on for two or three days, and then conjugation occurs. Actual conjugation has not been observed, but in preparations in which it has been effected the pairs of individuals generally have somewhat characteristic morphology. One is usually longer and not so plump-looking as the other, and the posterior extremity is turned slightly to one side. A foot-note states that it is considered that the tendency to adhere in couples is purely a matter of surface tension. A detailed description is given of the series of changes observed in a pair of these adherent and subsequently united individuals up to the time when by a process of shrinkage it becomes rounded in shape and provided with a cyst wall. Many hours appear to be necessary for the completion of the development. The biology of the parasite is to form the subject of further investigations, but it is said that repeated cultivations of the parasite while in the active condition leads to a loss of power of cyst-formation, the flagellates simply dying off after a time.

In some instances parasites with as many as five flagella and nuclei have been observed, these forms, however, do not become cysts, but divide. It is thought that they do not represent true syngamy, but are due to physical rather than vital factors. The authors think that the observations made on the non-conjugating strain, which they had cultivated through 35 generations during 20 weeks up to the time of writing, warrant the view that the power of cyst-formation and of undergoing true syngamy has been lost by it.

In the authors' view this has some bearing on the question of the absence of syngamy in trypanosomes, surfeit of nutrition and absence of any chemical substance to which flagellates react by conjugation explaining the absence of syngamy in the trypanosomes. The objections which may be raised are : trypanosomes may be inoculated indefinitely without showing conjugation ; binucleate flagellates of insects have an alternation of hosts but it appears to be unlikely that syngamy will be observed in them. In the third place in the Haemosporidia, in spite of alternation of host, conjugation occurs.

(87) STEPHENS (J. W. W.) On the Peculiar Morphological Appearances of a Malarial Parasite.—*Ann. Trop. Med. & Parasit.* 1915. Mar. 18. Vol. 9. No. 1. pp. 169-172. With 1 coloured plate.

In this paper the author refers to and figures malarial parasites found in a film of blood taken from a child on the Gold Coast which resembled the parasite described by him as *P. tenuis*. The slide in question was

prepared by Le FANU who noted the peculiarities of the organisms present in the blood before the author's description of *P. temue* was published.

The following points are emphasised. The blood cells show no evidence of stretching or distortion, and the peculiar forms of the parasite occur in all parts of the film. Large, apparently normal, quartan parasites are present and it is possible to trace a transition from the normal ring forms to those in which only particles or strands of chromatin occur without any cytoplasm. Three views as to the nature of the parasite appear to be possible: that they are a new species; that they represent degeneration forms; that they are artificial forms produced outside the body under unknown conditions.

(88) FRANCA (C.). *Quelques Observations sur le Genre Leucocytozoon.* [Some Observations regarding the Genus Leucocytozoon.]—*Bull. Soc. Path. Exot.* 1915. Apr. Vol. 8. No. 4. pp. 229-241.

The nature of the host cells of the Leucocytozoa.

The majority of the leucocytozoa are recognised by their sexual forms, and they can be divided into two groups based upon the appearance presented by the host-cells.

In the first group are the parasites which are oval in shape and are parasitic in cells which show fusiform prolongations. In the second group are the rounded parasites, the cell-hosts of which do not show such prolongations. The views that have been expressed by a number of observers regarding the nature of these host-cells are briefly recapitulated, and the author describes some of his own observations on the question.

He states that he has been able to establish the fact that the two types of leucocytozoa are in reality parasites of the red blood corpuscles, and that they are in fact erythrocytozoa.

With regard to schizogony in the Leucocytozoa the author concludes that, taking into consideration the observations of other investigators, the following facts may be considered as established:

Schizogony occurs in the internal organs and gives rise to a number of merozoites. The schizont does not possess any cyst wall. The processes of schizogony occur simultaneously in all the schizonts, so that in an infected animal in which the parasites are undergoing division all are in the same stage of multiplication. The periodic increase in the number of gametes of *L. caulleryi* in the blood of the host are explained by processes of schizogony.

The third section of the paper deals with the Genus *Leucocytozoon* and its characters.

The author thinks that although the parasites classed as leucocytozoa are in reality haemocystozoia, the name should be retained in spite of its being incorrect.

The adult gametes are of two distinct types morphologically and also in regard to the effect which they produce on the host cells. Structurally however the two types closely resemble each other.

The macrogametocytes of the round or of the oval type possess granular cytoplasm, and their nuclei, which are round, are composed of granules one of which is especially large and may be intra- or extranuclear in position. This granule is analogous in some of its characters to a blepharoplast.

The microgametocytes are also rounded or oval according to the species. They have a smaller amount of cell substance. Their nucleus is somewhat large, oval or irregular in outline, and shows no caryosome.

Ordinarily the parasites contain no pigment.

The microgametes closely resemble the corresponding stage of the plasmodia.

The genus *Leucocytozoon* should be included with the genera *Plasmodium*, *Laverania*, *Haemoproteus*, *Proteosoma*, and *Haemocystidium* in the family *Haemamoebidae* Ross.

- (89) MESNIL (F.). *Sur la Position Systématique des Hémosporidies.*
[The Position of the Haemosporidia in Schemes of Classification.]
—*Bull. Soc. Path. Exot.* 1915. Apr. Vol. 8. No. 4. pp. 241-244.

After discussing certain points raised in FRANÇA's paper (see above) regarding the classification of these parasites, the author concludes that the Haemosporidia, or better the Haemocytozoa, comprise a number of parasites which have no common characters save those that are common to the Coccidia in general. This method of grouping is not longer permissible. The names *Haemocytozoon* and *Leucocytozoon* may be retained to designate parasites occurring in one or other type of blood corpuscle, but it must be understood that these names have no taxonomic value.

- (90) ADIE (Helen). *The Sporogony of Haemoproteus columbae.*—
Indian Jl. Med. Research. 1915. Jan. Vol. 2. No. 3. pp. 671-680.
With 3 plates.

The author's work was carried out in connection with the investigations of ACTON and KNOWLES [see this *Bulletin*, 1914. Vol. 2. p. 180], and the results supplement those of these authors.

The fly used in the experiments was *Lynchia maura* and a few details are given regarding the general characters of this fly.

The fly is a small hippoboscid with a small abdomen and long overlapping wings. The total length of a new born fly is 5·5 mm. and the wings measure 7 mm. The front of the head is characterised by projecting palps, enclosing the haustellum. The flies begin to deposit pupae about a week after they have hatched out, and the mature fly emerges from the pupa case after a period ranging from 31 days upwards depending upon the temperature. The fly will feed upon a pigeon within a few hours of hatching.

The fly cannot be kept without food for more than 48 hours, and there appears to be nothing that can be substituted for blood as food. Both sexes carry the infection.

The alimentary canal of the fly conforms to the general plan seen in bloodsucking flies.

The salivary glands, which are about 1 mm. in length by 0·2 mm. in width, occupy a ventral position in the abdomen. The ducts from these glands, which are lined by large epithelial cells, lead to goblet shaped bodies which are lined with small papillae. Beyond these structures the ducts are thicker walled and coiled, and they subsequently join and lead to the bulb. The parasite, the flagellating parasites, and the

vermicules have been described by other authors and no repetition of their morphological characters is given here.

The zygotes are generally found in the lower part of the mid-gut, not far from the Malpighian tubes. They range in size from 7·2 microns to large bursting cysts measuring 36·5 microns. In these larger parasites bundles of sporozoites can sometimes be seen. The zygotes contain rounded particles of pigment scattered through their substance. The sporozoites have been found in large numbers in the salivary gland-substance and also in the secretion from the glands. The sporozoites are the ordinary sickle-shaped bodies as found in *Proteosoma* and measure from 7 to 10 microns.

Brief details are given of experiments which showed that new-born flies can acquire the infection from infected pigeons and also that infected flies can transmit the infection to clean pigeons. These experiments also furnished evidence which appeared to contradict ARAGAO's statement that if infected flies are fed for three days upon clean pigeons they cease to be infective.

- (91) GONDER (R.). *Zur Uebertragung von Haemoproteus columbae.* [The Transmission of *Haemoproteus columbae*.]—*Arch. f. Protistenk.* 1915. Mar. 1. Vol. 35. No. 3. pp. 316-323.

In this paper the author reiterates the views regarding the transmission of *Haemoproteus columbae* which he expressed at the International Medical Congress in London in 1913.

The conclusions arrived at as a result of his experiments carried out in 1910 in Africa may be summarised as follows:—

The parasite develops in the fly—*Lynchia capensis olfersia*—only as far as the ookinete stage, and flies remain infective so long as ookinetes persist in the stomach.

Flies become "clean" when they have a full meal on an uninfected pigeon, but the flies never become immune and can be reinfected. Flies cannot become "clean" when they feed upon infected pigeons.

The infection cannot be transmitted from pigeon to pigeon experimentally by inoculation with blood, but if the blood is first placed for a time in a moist chamber under conditions causing the production of ookinetes infection can be produced. It can also be produced by inoculating with materials derived from the lungs.

HELMINTHS.

- (92) GAIGER (S. H.). *A Revised Check List of the Animal Parasities of Domesticated Animals in India.*—*Jl. Comp. Path. & Therapeutics.* 1915. Mar. Vol. 28. No. 1. pp. 67-76.

"A preliminary check list was published in 1910 in the *Journal of Tropical Veterinary Science*, Vol. 5. No. 1. This list has now been considerably added to, revised, and corrected, and the older names by which parasites used to be known have been replaced by their more recent names."

- (93) SEURAT (L.-G.). Sur l'existence en Algérie, du *Dermatoxys veligera* (Rud.) et sur les affinités du genre *Dermatoxys*. [The Occurrence of *Dermatoxys veligera* (Rud.) in Algeria and the Relationships of the Genus *Dermatoxys*.—*C. R. Soc. Biol.* 1915. Mar. 19. Vol. 78. No. 5. pp. 75-79. With 4 text-figures.

Dermatoxys veligera (Rud.).—The parasite is white in colour and has a cuticle marked with a fine transverse striaion. The head is rather wider than the portion of the body immediately behind it. There are two large lateral alae which extend backwards as far as the bulb of the oesophagus. The excretory pore is very small and is situated just posterior to the bulb of the oesophagus. The mouth is margined by three lips each of which carries two papillae and on its inner face a tooth. The bulb of the oesophagus is devoid of any denticular apparatus which is so characteristic of the Oxyures. The oesophagus in the female measures $\frac{1}{3}$ the length of the body and in the male is rather longer. The nerve ring is placed in an anterior position. The male measures about 11 mm. in length and 435 microns at the thickest part. The body is straight or slightly curved at the caudal extremity. In addition to the cephalic alae there are two very long lateral wings on the posterior portion of the body which unite just in front of the extremity of the tail. The tail is regularly conical and the cloaca opens 400 microns in front of the extremity. At a point 700 microns in front of the cloaca there are 10 to 17 parallel cuticular ridges which are placed transversely in a manner resembling a curry comb. Between these ridges and the cloaca there are two rows of small projections.

The pericloacal area is covered with sessile papillae which nearly touch each other. In front of the anus there are six papillae, four of which are situated on the superior lip. The inferior lip shows three papillae of which the middle one is the largest. There are two large post-anal papillae.

The spicule is very small, measuring only 85 microns.

The female is about half as large again as the male. The conical tail is covered with a little sheath of brown chitin. The excretory pore opens 1.3 mm. from the bulb of the oesophagus. The vulva is not prominent and opens just anterior to the middle point of the body. The ovijector and the vagina have remarkably thick muscular walls. In its distal part the ovijector is related to a dark-coloured ovoid glandular structure.

The eggs are slightly flattened on one face and measure 110 by 50 microns. The inner surface of the shell is lined with a very distinct vitelline membrane and at one pole there is an area where the shell is less resistant.

The parasite occurs in the caecum of *Lepus kabilicus*.

- (94) RAILLIET (A.) & HENRY (A.). Sur un Cénure de la Gerbille à pieds velus. [A Coenurus of the Hairy-footed Gerbil].—*Bull. Soc. Path. Exot.* 1915. Apr. Vol. 8. No. 4. pp. 173-177. With 3 text-figures.

This parasite was found in the abdominal wall of a Tunisian gerbil. It measured 12.5 by 10.5 millimetres and its outer surface was slightly bosselated. On opening the cyst the bosselations were found to be much more prominent on the inner face, and each of them showed a number of secondary prominences on their surface.

Examination revealed that each of these secondary projections contained an invaginated scolex which was provided with a double row of hooks and four rounded suckers. The paper contains a list of the coenuri known up to the present together with a tabulated statement regarding the number and size of the hooklets present in each.

The authors conclude that the cyst described is a new species and suggest the name *Coenurus* or *Multiceps glomeratus*.

(95) SEURAT (L.-G.). *Sur deux nouveaux Spiroptères des Carnivores.*
[Two New Spiroptera of the Carnivora.]—*C. R. Soc. Biol.* 1915.
Apr. 30. Vol. 78. No. 7. pp. 157-161. With 6 text-figs.

1. *Habronema grimaldiae* n. sp.—This parasite has been found in the oesophagus and stomach of the Algerian fox upon two occasions, and, in all, two females and four males have been examined.

The general characters of the species are:—The body is stout in comparison with its length in the posterior two thirds, but the anterior third is attenuated. The thick cuticle is transversely striated, the striations being 12 microns apart. There are two precervical papillae symmetrically placed slightly anterior to the nerve ring. The buccal cavity shows two lateral lips which have three teeth upon them, and a dorsal and a ventral lip the edges of which are hollowed out. The buccal cavity is short, but the oesophagus is long. In the female this amounts to $\frac{2}{3}$ of the total length and in the male to nearly half. The excretory pore opens immediately posterior to the nerve ring.

The female is about 22 millimetres in length and is 780 microns in thickness at the thickest part. The tail is short and conical. The vulva is small and not prominent. It is placed about the middle point of the body. The ovijector is directed backwards, the vestibule has thick muscular walls, and its small lumen contains about six eggs. The uterus is Y-shaped. The epithelial cells lining the unpaired branch appear to be in contact with each other obliterating the lumen, but the paired branches which are a little longer run backwards and contain a number of eggs in linear series.

The ovaries are slender and long. The eggs have thick shells, and contain mature larvae. They measure 52 by 31 microns.

The males measure about 15 millimetres in length and 370 microns at the thickest part. The tail is curved at its extremity. The cloaca which is bordered by rather prominent lips opens 330 microns in front of the posterior extremity. In the precloacal region the ventral aspect of the body shows a number of small longitudinal ridges. The caudal wings measure 1.5 mm. The dorsal aspect of these shows a very loose transverse striation, while the ventral aspect shows longitudinal striations placed much more widely apart.

There are six pairs of pedunculated papillae near the cloaca, three pairs of very small papillae just in front of the extremity of the tail, and a large unpaired papilla on the superior lip of the cloaca.

The spicules are not quite equal in length, and the longer one which is rounded at its extremity is thicker than the finer one which terminates in a point. The longer spicule is about 1.5 mm. in length.

Habronema nouveli n. sp.—Only the female of this worm is known, and of these six specimens have been found in the stomach and intestine of a genet killed near Algiers.

This parasite is white or pinkish in colour and has two lateral wings which begin 80 microns behind the head and extend to a point one millimetre in front of the anus. The cervical papillae are asymmetrically placed, the left being anterior to the right. The excretory pore is very distinct and opens on the ventral surface of the body posterior to the right cervical papilla.

The mouth is bounded by two lateral lips carrying three teeth which project slightly into the buccal cavity. The rim of the buccal cavity shows three pairs of papillae.

The female is about 15 millimetres in length and has a short conical tail which is truncated obliquely, the truncated part showing about a dozen little prominences arranged in a circle. The oesophagus is about "1/5, 7" the length of the body, and the vulva, which is difficult to make out, opens immediately anterior to the middle point of the body. The ovijector exactly resembles that of *Habronema chevreuxi*.

The extremities of the branches of the uterus form S-shaped curves. The oviducts are 800 microns in length and the ovaries 3·5 mm. in length and narrow.

The eggs are elliptical, possess thick shells, and measure 38 by 20 microns.

The male parasite is unknown.

- (96) SEURAT (L.-G.). Sur deux nouveaux parasites du Renard d'Algérie. [Two New Parasites of the Algerian Fox.]—*C. R. Soc. Biol.* 1915. Apr. 2. Vol. 78. No. 6. pp. 122-126. With 4 text-figs.

Spirocera subaequalis Molin.—A single female of this species was found in a tumour near the pylorus of the stomach of one of two Algerian foxes examined. (For a description of this parasite see this *Bulletin*. Vol. I. No. 5. Dec. 1913. p. 312. In the original of the paper there abstracted the author referred to the parasite as *Spiroptera subaequalis*.)

The other parasite, *Allodapa numidica* n. sp., was found in the caecum. In one of the foxes there were 88 females and 34 males, and in the second one male and three females were found.

The general characters of this species are as follows:—

The body is straight and slender except for a curving of the tail in the male. The cuticle is thick and very closely striated transversely. There are no cephalic alae. The excretory pore opens on the middle line of the ventral surface not far from the nerve ring.

There are two lateral lips to the mouth, but they are not very well marked. Each carries three papillae. The buccal cavity is divided into two portions. The upper part is bounded by a thick chitinous wall, while the lower portion, which has equally thick walls, has three slightly projecting teeth marking the entrance to the oesophagus.

The oesophagus is slightly swollen in the posterior part and connects by means of a constricted part with a distinct bulb containing the teeth.

The male worm measures from 13·5 to 18 mm. in length and 370 microns at its thickest part.

The tail may show either a slight curve or a complete turn. The cloaca has prominent lips. The caudal alae are very small. On the

ventral surface there is an oval area showing marked transverse striation and surrounded by series of rectangular plates of cuticle. There are four pairs of pre-anal and six pairs of post-anal papillae. The caudal glands open immediately behind the second pair of papillae.

The spicules measure 600 and 440 microns in length. The large one is striated transversely and its free portion is thickened.

The female measures about 25 mm. in length. The excretory pore opens 600 microns from the cephalic extremity. The vulva is prominent and opens immediately in front of the junction of the anterior and middle thirds of the body. It is connected with an oviojector 1 mm. in length. The oviojector has very thick walls and is lined with cuticle continuous with the external cuticle.

Three parts of the sphincter are distinguishable. The first part has a very thick cuticular lining, the middle portion has a number of elongated cells placed transversely between the muscular coat and the lining, and in the third portion the muscular coat gradually diminishes in thickness.

The branches of the uterus are very long and are folded upon themselves a number of times.

There is no distinct seminal vesicle. The ovaries are about 4·5 mm. in length and are placed one immediately in front of and the other immediately behind the vulva.

The eggs have thin envelopes and measure 63 microns in diametre. They are nearly round, and contain mature embryos.

BITING FLIES.

- (97) ROUBAUD (E.). *Sur un essai d'élevage de Glossines dans les laboratoires d'Europe.* [An Attempt to raise Glossinae in the Laboratories of Europe.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 34-36.

This paper contains what appears to be the first record of attempts to raise Glossinae in European Laboratories. The author who returned from Senegal in December 1913 brought with him about a score of pupae belonging to the species *G. palpalis* and *G. morsitans*. The older pupae were killed off by the cold during the winter, but the younger ones survived and a certain number of adults were hatched out in the Pasteur Institute. The flies were kept in incubators at 24-25° C. and were fed daily upon guinea-pigs or rabbits.

Only two specimens of *G. palpalis* were obtained and both of these were males. These flies lived for about five weeks, but the absence of any females made it impossible to raise a fresh generation.

The pupae of *G. morsitans* gave rise to two males and six females. One of these flies formed the starting point of a strain which had at the time of writing been maintained for a year. The conditions under which the flies were kept were: a temperature of 24° to 25° C. and an average humidity of 50-55 per cent. At this temperature a larva was produced every 10 or 11 days, and one of the flies dropped as many as 14.

The duration of life of the flies varied from three weeks to five-and-a-half months, and the period elapsing between the formation of the pupa and hatching was from four to five weeks. The total number of descendants obtained from one of the flies during the course of the year was only twenty, but a number were lost through accidental causes during the months of August and September.

It is said that to raise the flies satisfactorily in incubators there must be some means of ventilating them so as to obtain a change of air, as otherwise the development is poor. In the case of *G. morsitans* a higher percentage of moisture than 60 is to be avoided.

During June some of the flies were exposed to a temperature of 10° to 27° C. for a period of a week and they survived, but the author thinks that Glossinae would never survive in Europe under natural conditions.

RABIES.

- (98) MOON (V. H.). **Further Observations on the Effect of Quinin in Rabies.**—*Jl. Infect. Dis.* 1915. Jan. Vol. 16. No. 1. pp. 58-62.

The author gives a summary of seven groups of animals—rabbits and dogs—which were infected experimentally with rabies (street virus) and treated with quinine either by the mouth, or by subcutaneous and intravenous injection.

A brief account is also given of two cases of rabies in the human subject which were subjected to treatment along the same lines. In both of these cases the disease was somewhat far advanced when treatment was resorted to.

The conclusions may be summarised as follows:—

Quinine is not constantly effective either as a cure or as a protective agent in rabies in animals, and when given in the later stages of cases of the disease in man it produces no significant results. It would appear to have the effect of retarding the development of the disease if given in large dose during the period of incubation.

- (99) KRUMWIEDE (C.) Jr. & MANN (Alice G.). **The Effect of Quinin on Rabies.**—*Jl. Infect Dis.* 1915. Jan. Vol. 16. No. 1. pp. 24-25.

The experiments recorded in this paper were carried out to check the results published by MOON in 1913. Owing to the results obtained the work was discontinued, but the negative results published by CUMMINGS, and by FROTHINGHAM and HALLIDAY, warrant the publication of the authors' results.

A number of rabbits were inoculated intracranially with fixed virus and were subsequently treated with quinine, the treatment being started on different days after the inoculations. Quinine bisulphide was used in a 1 to 8 solution in water and it was administered by injection, but it is not stated by what path the injections were given. Some of the rabbits were killed with quinine.

The quinine did not appear to have the least effect upon the course of the disease.

Six dogs which had been inoculated intracranially with street virus were also subjected to treatment with quinine, but save for one case in which the period of incubation was rather prolonged, although not beyond what is seen in natural cases, and one case in which there was a remission during the course of the disease, all the animals reacted in a normal way and died. The virus obtained from these dogs was pathogenic for guinea-pigs, and typical Negri bodies were found in the brain tissue of each one of the dogs.

MISCELLANEOUS.

- (100) GRIFFITHS (J. A.). **Demodectic Mange of Domesticated Animals in Nyasaland.**—*Jl. Comp. Path. & Therapeutics.* 1915. Mar. Vol. 28. No. 1. pp. 61-64. With 1 text-fig.

The disease appears to have been first recognised about five years ago, but it is probable that it was introduced by imported animals some years previously.

Practically all the cases that have been seen have occurred in the Shire Highlands, where the disease has been found in cattle, sheep, pigs, dogs, and cats. It is, however, among cattle that the greatest amount of infection has been found.

The first evidence of infection is the appearance of a crop of nodules on the skin, generally in the neck and shoulders. These gradually spread to the rest of the body, and in neglected cases tend to coalesce and burst, discharging purulent contents. The inflammation resulting causes the skin to become harsh, wrinkled, and denuded of hair.

The disease may persist in the nodular stage without material alteration for periods extending to 18 months or even longer. Affected animals may become very emaciated and in some cases this emaciation may lead to a large percentage of deaths.

Treatment has been limited to prophylactic measures, save for the spraying or dipping of animals that are not sufficiently seriously affected to warrant their slaughter.

In pigs and sheep the nodular condition is not seen, but small pustules make their appearance and subsequently coalesce. There may be very marked emaciation, and many animals die.

In the dog and the cat the disease makes its first appearance on the ears, but subsequently it spreads to the rest of the body.

In those cases in cattle in which the contents of the nodules are purulent rather than cheesy the course of the disease is generally more rapid, and death more commonly occurs.

- (101) PINOY (E.) & MASSON (P.). **Mycétome du poumon chez l'âne.** [Mycetoma of the Lung in the Donkey].—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1. pp. 11-12.

The parasite was discovered in a tumour-like growth in the lung of a donkey, and on examination it appeared to be identical with that described by GRIJNS as an ascosporous form of *Aspergillus fumigatus*.

- (102) KERANDEL (J.). *Insectivore réservoir de virus de la peste au Cambodge.* [An Insectivore as a Reservoir for the Virus of Plague in Cambodia.]—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 54-57.

A musk rat (*Crocidura murina*), which was found dead in a house where a case of plague had occurred, proved to be infected with an organism which the author identified as the plague bacillus on the grounds of cultural and experimental inoculation results. Examination of musk rats showed that *Laemopsylla cheopis* was more numerous on them than on rats in the same district.

The conclusion drawn is that *Crocidura murina* may act as a reservoir for the virus of plague in exactly the same way as the rat.

- (103) NÈGRE (L.) & BOQUET (A.). *Sur la culture du parasite de la lymphangite épidémiologique.* [The Cultivation of the Parasite of Epizootic Lymphangitis]—*Bull. Soc. Path. Exot.* 1915. Feb. Vol. 8. No. 2. pp. 49-52. With 6 text-figs.

In this paper the authors describe some further investigations regarding the cultivation of the cryptococcus. (For previous communication see this *Bulletin*, Vol. 2. No. 3, p. 152.)

The following media have been used:—Coagulated horse or sheep serum to which 6 per cent. of glycerin was added, horse serum agar, ordinary peptone agar, bean agar (*gélose au haricot*) containing 2 per cent. of glucose and not neutralised. The pus was sown out in the water of condensation of these media to which were added about 20 drops of unneutralised bean broth containing 2 per cent. of either glucose, lactose, or saccharose.

Two forms of development have been observed. On the second or third day some of the cryptococci increase in size and show in their interior a variable number of droplets of oil. These give rise to a number of buds which are divided off from the parent organism by septa. The buds increase in length and become segmented into a series of elements, and from these secondary septate threads are given off. The threads do not as a rule exceed 15 microns in length, but exceptionally they may be as long as 30 microns. Their breadth varies from 2 to 4 microns. There is a distinct double contour and the hyphae show at intervals swellings which may measure 10 microns in diameter. The organisms are difficult to stain.

The mycelial forms described by TOKISHGE and MARCONE make their appearance in a week to a fortnight. Since intact cryptococci and large forms containing droplets of oil may be present at the same time, it is probable that the filaments present in cultures of the second and third generation are not derived from the previous mycelial forms but by a delayed vegetation of cryptococci.

In other cryptococci it was observed that 48 hours after inoculation they had become enlarged and rather rounded in shape, and that the double contoured envelope had an irregular outline. The protoplasm was slightly granular, but did not contain any droplets of oil. Parasites of this type measured from 4 to 6 microns in diameter. Some of them showed a delicate septum across the centre.

These forms were always adherent to the surface of the medium while the mycelial forms were always free in the liquid. The rounded forms resisted all efforts to stain them.

The optimum temperature for growth is between 20° and 30° C. The best media were coagulated horse and sheep serum to which glycerin had been added.

- (104) TERRY (B. T.). Different Amounts of Transformed Atoxyl produced by incubating one per cent. and ten per cent. Atoxyl in Blood.—*Jl. Experim. Med.* 1915. Mar. Vol. 21. No. 3. pp. 258-266.

The Summary of this paper is as follows :—

“ 1. Ten per cent. atoxyl in blood incubated at 37° C. for 1 hour gives rise to a solution that is much more than ten times as toxic as a 1 per cent. solution of atoxyl similarly incubated.

“ 2. When the comparison is made after incubation for 3 hours instead of for 1 hour, the toxicity of the 10 per cent. solution is but slightly greater than ten times that of the 1 per cent., provided the red blood corpuscles are not removed from the dilutions.

“ 3. If the corpuscles are removed from both the 10 per cent. and the 1 per cent. atoxyl solutions immediately after incubation at 37° for 1 to 3 hours, the dilutions of the 10 per cent. atoxyl are much more than ten times as toxic as the corresponding dilutions of the 1 per cent. atoxyl.

“ 4. After incubation with atoxyl at 37° for 1 to 3 hours, red blood corpuscles left at room temperature in dilutions made from the 10 per cent. and 1 per cent. solutions in blood increase markedly the toxicity of the dilutions made from the 1 per cent. atoxyl, but increase very slightly the toxicity of the dilutions made from the 10 per cent. atoxyl.

“ 5. If one desires to produce a large amount of transformed atoxyl by incubating atoxyl in blood at 37° for 1 to 3 hours, strong solutions of atoxyl should be chosen in preference to weaker solutions.”

- (105) TERRY (B. T.). The Effect of Heat on the Transforming and Binding Power of Blood.—*Jl. Experim. Med.* 1915. Mar. Vol. 21. No. 3. pp. 267-279.

Summary :—

“ 1. The transforming power of red blood cells for atoxyl is apparently uninfluenced by a preliminary heating of the blood for 30 minutes at 50° C., but a temperature of 55° C. acting for 30 minutes destroys this property of blood almost completely.

“ 2. When the heating was for 60 minutes, 54° C. and higher temperatures apparently destroyed all the transforming power.

“ 3. After heating for 10 minutes, 70° C. destroyed almost all the transforming power, and 100° C. seemingly destroyed all.

“ 4. Under the influence of certain temperatures blood seemingly binds transformed atoxyl, and under the influence of other temperatures frees it again. A temperature of 70° C. for 10 minutes applied to blood subsequent to its incubation with atoxyl causes nearly all the toxicity of the solution to disappear. On the other hand, a temperature of 100° C. for 10 minutes applied to blood subsequent to incubation with atoxyl leaves the solution almost as toxic as if the blood had not been heated at all after the incubation.

“ 5. Some of the transformed atoxyl bound by blood when it is heated to 70° C. for 10 minutes is freed if the heating at 70° C. is prolonged to 30 minutes.

“ 6. Blood which has bound transformed atoxyl gives up most, but not all, of this toxic substance when heated to 100° for 10 minutes. All, or nearly all, is freed when the heating at 100° C. is continued for 30 minutes.

" 7. Under the influence of 70° C. for 10 minutes transformed atoxyl may be made to enter blood corpuscles, for the fluid above these corpuscles is rendered non-toxic and does not become toxic again when heated to 100° for 20 minutes, provided it contains no laked blood. The blood corpuscles, on the other hand, when heated to 100° for 20 minutes, in contact with fresh salt solution, make this solution quite toxic.

" 8. Laked blood in contact with transformed atoxyl behaves like unlaked blood when heated to 70° C. and to 100° C. for 10 to 30 minutes.

" 9. The toxic substance can be concentrated by heating the blood corpuscles in contact with transformed atoxyl to 70° C. for 10 minutes, centrifugalizing, removing a large part of the supernatant fluid, and then heating to 100° C. for 30 minutes.

" 10. The power of blood to take up and bind transformed atoxyl is destroyed apparently completely by heating blood to 100° C. for 10 minutes.

" 11. The toxic substance into which atoxyl is transformed (transformed atoxyl) is thermostable, but the transforming agent in blood is thermolabile."

(106) HENRY (M.). Mortality among Cattle in the Bega District of New South Wales.—*Vet. Jl.* 1915. Feb. Vol. 71. No. 476. pp. 62-72.

In this paper the author describes a peculiar disease among cattle which has occurred during February and March each year since 1912. The majority of the animals affected were cows in full milk, and it was only in those areas in which the country was very poor that cases occurred in animals other than milking cows. It also appeared that the disease caused greater losses on farms where attempts had been made to improve the milking capacity of the animals by the importation of Jersey bulls and by other means.

Generally speaking the area affected has steadily increased, but it was noted that in areas where recurrence of the disease did not occur the food supply, which was in general limited to grazing on land greatly infested with rabbits, had been improved. In every case the disease disappeared with the onset of rain. On all the affected farms depraved appetite was common among the cattle, they would chew bones, stocks, dead rabbits, and would eat indigestible and astringent plants.

The affected animals rapidly lost condition and lactation ceased somewhat suddenly. There was evidence of dull abdominal pain, the animals moved stiffly, and in the later stages lay on their sides. The tongue was protruded, salivation was free, and the muscles of mastication and deglutition were paralysed. Death occurred in from 12 hours to a fortnight after symptoms had been observed. Recovery was not common.

The post-mortem appearances were very indefinite and inconstant.

Infection as a causal factor in the production of the disease appears to be excluded. Mortality ceases when cattle are moved from affected to non-affected areas, and animals with which they are mixed do not contract the disease. A fall of rain and improvement in the feeding bring the disease to an end. No known poisonous plant could be detected on affected areas, nor could any fungus on the grass be implicated.

It was particularly noted that the disease occurred where bone chewing and osteomalacia had been previously observed.

Chemical analysis of soils and grasses appeared to indicate a definite connection between poverty of the soil and of the food, and also between poverty of the food and the mortality.

The author inclines to the view that the disease is a deficiency disease, and reference is made to STEAD's statement in connection with lamzieke to the effect that milk contains a substance which possesses protective properties, and draws attention to the fact that in one instance mortality which was very high in a herd of cows suckling their calves rapidly ceased when the calves were weaned.

- (107) GRAYBILL (H. W.). Repellents for protecting Animals from the Attacks of Flies.—*U. S. Dept. of Agric. Bulletin No. 131.* 1914. 26 pp.

The following is an abstract of the general summary of the matter contained in this *Bulletin* :—

In the United States the principal flies which cause annoyance to cattle are *Stomoxys calcitrans* and *Lyperosia irritans*, and there are certain other flies which, although they do not bite, cause a considerable amount of unrest among animals.

It is thought that the losses generally attributed to the biting flies are exaggerated to some extent.

One author records that flies object to a blue colour, and that they can be banished from cattle sheds by colouring the walls with a blue-coloured wash. It does not appear that this observation has been corroborated. It has been noted by a number of observers that dark coloured animals are more troubled by flies than light coloured ones.

Internal medicaments appear to be of no value as repellents.

Liquids may be applied to the skins of animals by dipping, spraying, or by painting, the method adopted depending upon the nature and the cost of the material used.

Powdered drugs such as pyrethrum are of very little value.

Fish oil is said to be very effective, and it may be used in conjunction with such materials as oil of tar, crude carbolic acid, and kerosene. Such mixtures may be effective for as long as a week. They should be applied lightly with a brush, but they are not safe when used liberally with a spray pump. Pure laurel oil is effective but irritant. Ten per cent. laurel oil in cotton seed oil was found by the author to be ineffective.

Various mixtures of carbolic acid and pine tar in cotton seed oil were found to exercise a repellent action, but they were not effective for more than a day. Oil of tar in cotton seed oil and in Beaumont oil is effective, but such mixtures are not safe to apply liberally if there is 50 per cent. of oil of tar present. The mixtures containing 10 per cent. of oil of tar must be applied every day.

A heavy application of fish oil causes the hair to become sticky and fall out, but a light application does not produce these results.

- (108) GRAYBILL (H. W.). The Action of Arsenical Dips in preventing Tick Infestation.—*Jl. of Parasitology.* 1914. Sept. Vol. 1. No. 1. pp. 48-49.

A previous paper by the author on this subject was published by the Bureau of Animal Industry in 1913 [see this *Bulletin*, Vol. 1, No. 5, Dec. 1913; p. 318], and the results obtained in the experiments

recorded in that paper showed that cattle dipped in an arsenical dip are protected from becoming infested with ticks for two days, but not for five.

The experiments referred to in the present communication were carried out with the object of ascertaining whether such dipping confers any protection for three or four days, and whether any mortality occurs among ticks placed upon or maturing upon immune animals that have been dipped on a number of occasions at intervals of one or two weeks.

The dip used contained 8 pounds of white arsenic to 500 gallons, but no pine tar was mixed with it.

In the first experiments non-immune calves had placed upon them seed ticks at intervals of three and four days after dipping, other similar calves being left as controls. It was found that while the animals were not absolutely protected from the ticks the infestation in the dipped animals was lighter than in the controls, and, in view of the fact that no dead nymphs were found, it would appear that the lighter infestation was due to an action of the dip upon the larvae.

The second experiment was primarily intended to show whether ticks that have matured on animals that have been regularly dipped show any mortality after dropping off.

Immune calves were divided into three groups. One group was dipped four times at intervals of two weeks, a second group was dipped four times at intervals of one week, and the third batch were left as controls. The ticks were applied five days after the last dipping. The results showed that the dipping does not prevent infestation entirely, but that it reduces it to some extent when the animals are dipped at intervals of a week. The ticks collected showed no abnormality in connection with oviposition and the number of eggs hatching, and the mortality was normal.

- (109) CHAPIN (R. M.). Arsenical Cattle Dips: Methods of Preparation and Directions for Use.—*U.S. Dept. Agric. Farmers' Bulletin 603.* 1914. Aug. 14. 16 pp.

This bulletin contains a brief but general summary regarding the preparation and management of arsenical dipping solutions, and is written for the use of the farmer.

The following subjects are dealt with: substances used for making dips and their properties, including antidotes to be used in cases of poisoning; the general composition of dips and the methods of preparing. Diluting the dip, replenishing the bath, correcting the strength, calculating the capacity of a vat, and the safe disposal of waste arsenical baths are also dealt with.

- (110) KOLMER (J. A.). A Method of transmitting Blood Parasites.—*Jl. Infect. Dis.* 1915. Mar. Vol. 16. No. 2. pp. 311-312.

This short paper contains a description of a method by which blood can be drawn from the heart of living rats without causing any disturbance of health. The skin over the heart is sterilised with tincture of iodine and a sharp syringe needle of suitable size is used to puncture the heart, the blood being withdrawn into a syringe containing citrate solution. In this way practically all chance of contamination is avoided.

(111) BOQUET (A.). *Sur les Principales Affections Contagieuses des Animaux de l'Afrique du Nord.* [The Principal Contagious Diseases of Animals occurring in Northern Africa.]—*Bull. & Mém. de la Soc. des Sci. Vet. de Lyon.* 1914. July 2. 30 pp. With 8 figs.

Solipeds:—

Epizootic Lymphangitis.—The author summarises our knowledge regarding this disease and confirms its occurrence in Algeria, Morocco, and Tunis.

Dourine.—This disease has a wide distribution in Algeria. It is most frequently the chronic form which comes under observation. The usual three stages of oedema, plaques, and progressive paralysis are observed. The period of incubation is generally two to three weeks. During the third stage superficial abscesses and conjunctivitis and ulcerative keratitis are seen. Fractures of the limbs are common. In the acute form of the disease the symptoms develop rapidly and death may take place a few days after the onset of locomotor disturbance. Exceptionally horses recover spontaneously, but in the donkey recovery is far more frequent.

The author gives a text-figure of a trypanosome dividing into four daughter trypanosomes.

Taher—Mal de la Zousfana—Debab.—This disease has also a wide distribution. It is characterised by loss of appetite, weakness, and short attacks of high fever. There is progressive paralysis, and at times haematuria is observed. Death generally takes place in from 4 to 6 months. The causal trypanosome is present in the blood in large numbers, and is identical with that causing debab in dromedaries. The latter animals form the reservoir of the virus, and the infection is transmitted from them to horses through the medium of biting flies.

Piroplasmosis.—Acute, sub-acute and chronic cases of this disease are encountered. The causal parasite is *P. equi* and the disease is transmitted by *Ixodes*. Intramuscular injections of biniodide of mercury and trypanblue (4 to 6 g. in 1 per cent. solution in water) have yielded good results in the treatment of the condition.

Cattle:—

Piroplasmosis.—It would appear that more than one kind of piroplasmosis occurs among cattle in Algeria, as the author refers to the occurrence of parasites closely resembling *P. bigeminum* and also to organisms that are rod-shaped. It is also said that in some animals 60 to 80 per cent. of the blood corpuscles may be invaded without the animals showing any symptoms. *Anaplasma* also occurs in Algeria.

Black Quarter.—This disease is stated to be one of the most serious occurring in Algeria, but good results have followed the application of different methods of vaccination. Especially good results have been obtained with the method of LECLAINCHE and VALLÉE.

Sheep Pox.—This disease appears to be less severe during the summer than during the autumn and winter. The mortality ranges on an average from 6 to 10 per cent., but occasionally may be as high as 30 per cent. In young lambs more than 50 per cent. sometimes die. The disease causes great loss of condition and the period of convalescence is very prolonged. Pregnant animals frequently abort, and the secretion of milk is to a great extent suppressed.

Owing to the risks attaching to the importation of sheep from Algeria into other countries a method of vaccinating has been devised. The vaccine consists of a sensitised virus prepared by mixing material containing the virus with anti-pox serum prepared in the manner devised by BORREL, and incubating the mixture for 3 to 5 days at 18–20° C. The mixture is then centrifuged and the sediment added to salt solution in the proportion of 0·005 g. to 0·1 g. per cubic centimetre. This material is injected deeply into the skin behind the shoulder and produces on the fifth or sixth day an area of oedema varying in size up to the palm of the hand. In two or three days this decreases and a little nodule about the size of a nut is left. The method causes no disturbance of health and immunity is complete by the third day and lasts for a year.

The disease occurs in a more serious form in Morocco than in Algeria.

El R'och.—This is a disease of the sheep which is characterised by symptoms of anaemia and progressive cachexia. In the author's view a bacillus of the Preisz-Nocard type, which he has been able to isolate in pure culture from the heart blood, is possibly the cause of the condition.

Bou Frida of Goats.—This name is used to designate a disease of the goat which takes the form of an epizootic pleuro-pneumonia, but it is probable that more than one condition is included under the term. The mortality may reach 60 per cent.

El Debab of Dromedaries.—This disease is caused by a trypanosome *T. berberum*—discovered by the brothers SERGENT in 1904. It is encountered throughout the whole of the northern countries of Africa. According to the describers two species of fly are concerned in the transmission of the trypanosome—*Atylototus tomentotus* and *Atylototus nemoralis*, which are active principally during the month of June.

The disease is frequently responsible for abortion in the female.

Leishmaniasis of the dog.—This disease has been detected in 2·5 per cent. of the dogs killed at the public slaughter-houses, and the author states that infantile kala azar has been found in every place where the condition has been detected in the dog. The course of the disease varies from a few weeks to 15 or 16 months. Transmission is effected through the medium of fleas.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 3, No. 1, pp. 39-40.]

Leishmaniasis.

- (112) LIGNOS (A.). Quelques nouveaux cas de guérison de Kala-Azar infantile observés à Hydra. [Some Fresh Cases of Recovery from Infantile Kala-Azar on the Island of Hydra.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1, pp. 25-28.

Rabies.

- (113) PHISALIX (Mme. M.). Mécanisme de la résistance des Batraciens et des Serpents au virus rabique. [The Mechanism of the Resistance offered by Batracians and Serpents to the Virus of Rabies.]—*Bull. Soc. Path. Exot.* 1915. Jan. Vol. 8. No. 1, pp. 13-16.

Tick Paralysis.

- (114) STRICKLAND (C.). Note on a Case of "Tick-Paralysis" in Australia.—*Parasitology*. 1915. Mai. Vol. 7. No. 4, p. 379.

Trypanosomiasis.

- (115) AUBERT (P.). Essais de traitement de la trypanosomiase humaine par les dérivés du Diaminoarsénobenzene O₁ et OK₁. [Attempts to treat Human Trypanosomiasis with the Derivatives of Diaminoarsenobenzene O₁ and OK₁.]—*Bull. Soc. Path. Exot.* 1915. Apr. Vol. 8. No. 4, pp. 169-172.

Undulant Fever.

- (116) BULLETIN DE L'OFFICE INTERNATIONAL D'HYGIENE PUBLIQUE. 1915. Feb. Vol. 7. No. 2, pp. 255-299, & Mar. No. 3, pp. 485-501.—Fievre Ondulante. [Undulant Fever.] i. by JORGE (Ricardo), ii. by SERGENT (Edm.) & NEGRE (L.), iii. by de COTTES (J. Duran), iv. by SANTOLIQUIDO, v. by NICOLLE (Ch.).

Biting Flies and Ticks.

- (117) CARTER (H. F.). On Some previously Undescribed Tabanidae from Africa.—*Ann. Trop. Med. & Parasit.* 1915. Mar. 18. Vol. 9. No. 1, pp. 173-196. With 9 text-figs. & 1 plate comprising 6 figs.

- (118) CRAGG (F. W.). A Preliminary Note on Fertilization in *Cimex*.—*Indian Jl. Med. Research*. 1915. Jan. Vol. 2. No. 3, pp. 698-705. With 1 plate comprising 2 figs.

- (119) CRAGG (F. W.). The Alimentary Tract of *Cimex*.—*Indian Jl. Med. Research*. 1915. Jan. Vol. 2. No. 3, pp. 706-720. With 2 plates & 2 text figs.

- (120) CUNHA (R. de A.). Contribuição para o conhecimento dos sifonapteros brasileiros. [The Brazilian Siphonaptera.]—*Mem. Inst. Oswaldo Cruz*. 1914. Vol. 6. No. 2, pp. 124-136. With 2 plates & 3 text-figs.

- (121) HADWEN (S.). Warble Flies. A Further Contribution on the Biology of *Hypoderma lineatum* and *Hypoderma bovis*.—*Parasitology*. 1915. Mar. Vol. 7. No. 4, pp. 331-338.

- (122) HARRISON (L.). On a New Family and Five New Genera of Mallophaga.—*Parasitology*. 1915. Mar. Vol. 7. No. 4, pp. 383-407. With 2 plates & 3 text-figs.

- (123) LUTZ (A.) & NEIVA (A.). As "Tabanidae" do Estado do Rio de Janeiro. [The Tabanidae occurring in the State of Rio de Janeiro.]—*Mem. Inst. Oswaldo Cruz*. 1914. Vol. 6. No. 2, pp. 69-80.

- (124) NUTTALL (G. H. F.). Observations on the Biology of Ixodidae. Part II.—*Parasitology*. 1915. Mar. Vol. 7. No. 4, pp. 408-456.
- (125) ROUBAUD (E.). Les muscides à larves piqueuses et suceuses de sang. [Biting and Blood-sucking larvae of Muscidae.]—*C. R. Soc. Biol.* 1915. Mar. 19. Vol. 78. No. 5, pp. 92-97. With 2 figs.
- (126) SCHWETZ (J.). Preliminary Notes on the Mosquitoes of Kabinda (Lomame), Belgian Congo.—*Ann. Trop. Med. & Parasit.* 1915. Mar. 18. Vol. 9. No. 1, pp. 163-168.
- (127) SEN (S. K.). Observations on Respiration of Culicidae.—*Indian Jl. Med. Research*. 1915. Jan. Vol. 2. No. 3, pp. 681-697. With 4 charts and 3 text-figs.

Helminths.

- (128) TRAVASSOS (L.). Contribuição para o conhecimento da fauna helmintológica brasileira. III. Novo gênero da família Heterakidae Railliet & Henry. [Contribution to the Study of Brazilian Helminthology. III. A New Genus of the Family Heterakidae Railliet & Henry.]—*Mem. Inst. Oswaldo Cruz*. 1914. Vol. 6. No. 2, pp. 139-142. With 1 plate comprising 3 figs.
- (129) WARD (H. B.) & HIRSCH (E. F.). The Species of Paragonimus and their Differentiation.—*Ann. Trop. Med. & Parasit.* 1915. Mar. 18. Vol. 9. No. 1, pp. 109-162. With 5 plates comprising 23 figs.
- (130) YAKIMOW (W. L.), SCHOCHOS (N. I.), KOSELKIN (P. M.), WINOGRADOW (W. W.) & DEMIDOW (A. P.). Die Mikrofilariose der Pferde im Turkestan Gebiete. [Equine microfilariosis in Turkestan.]—*Zeitschr. f. Infektionskrankh. parasit. Krankh. u. Hyg. d. Haust.* 1915. Jan. 13. Vol. 16. No. 4, pp. 275-286.

Protozoa.

- (131) KUEHN (A.). Ueber Bau und Encystierung von *Bodo edax* Klebs. [The Structure and Encystment of *Bodo edax* Klebs.]—*Archiv. f. Protistenk.* 1915. Mar. 1. Vol. 35. No. 3, pp. 212-255. With 1 plate comprising 58 figs.
- (132) LÉGER (L.) & DUBOSCQ (O.). Etude sur *Spirocystis nidula* Lég. et Dub. Schizogrégarine du *Lumbriculus variegatus* Müll. [*Spirocystis nidula* Lég. & Dub. Schizogregarine of *Lumbriculus variegatus* Müll.]—*Archiv. f. Protistenk.* 1915. Mar. 1. Vol. 35. No. 3, pp. 199-211. With 1 plate comprising 19 figs. & 4 text-figs.
- (133) MOROFF (T.). Zur Kentniss der Sarkosporidien. [Contribution to our Knowledge regarding the Sarcosporidia.]—*Arch. f. Protistenk.* 1915. Mar. 1. Vol. 35. No. 3, pp. 256-315. With 4 plates & 2 text-figs.

Miscellaneous.

- (134) BROWN (H. C.) & KIRWAN (E. W. O'G.). Standardisation of Bacterial Suspensions by Opacity.—*Indian Jl. Med. Research*. 1915. Jan. Vol. 2. No. 3, pp. 763-769.

TROPICAL DISEASES BUREAU.

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THEILERIASIS.

(135) CARPANO (M.). *Piroplasmosi tipo "parvum" nei bovini del basso bacino del Mediterraneo (Febre della costa mediterranea).* [Piroplasmosis of the "parvum" Type in Cattle on the Southern Border of the Mediterranean. Mediterranean Coast Fever.]—*La Clinica Vet.* 1915. June 30. Vol. 38. No. 12. pp. 497-529; July 15 & 30. No. 13-14. pp. 553-596. With 2 plates comprising 12 figs., 14 text-figs. & 4 charts.

The author has studied this disease in imported Serbian cattle, of which 100 per cent. became infected and 90 per cent. died. Clinically, an acute or fulminant form, a subacute, and a chronic form may be recognised.

In the acute form the period of incubation may range from 10 to 30 days, the disease being ushered in with a rapid rise of temperature. For two or three days nothing abnormal may be observed, but then rumination ceases, the appetite becomes capricious, the temperature remains high, and the pulse and respirations become very rapid. The blood remains unaltered to the naked eye, and parasites may be numerous or scanty in it. The urine remains clear. There is a watery discharge from the eyes, the eyelids become oedematous, and the superficial lymphatic glands become enlarged. The visible mucous membranes show petechiae or haemorrhages, and muscular spasms and contractions occur. Within four or five days the temperature falls and the animal dies.

The subacute form has been most frequently observed, and the symptoms resemble those seen in the acute cases, but they do not follow each other so rapidly. In this form the duration of the disease is about one to three weeks and, if the infected animal survives, the disease acquires the characters of the chronic form.

In this form of the disease the temperature curve is rather characteristic. There are marked elevations of temperature which persist for from two to eight days, and are separated from each other by afebrile periods. In cases in which recovery is going to take place the febrile periods become gradually less marked.

The symptoms are those of a chronic piroplasmosis. The skin becomes harsh and adherent, the mucous membranes are jaundiced, and the urine contains albumen and is stained with bile. Microscopic examination of sediment from the urine shows epithelial casts. Pulse and respirations are accelerated, the former being sometimes almost imperceptible.

Examination of the blood may show that the number of red corpuscles has fallen as low as 3,000,000 per cubic millimetre, and there is a hyperleucocytosis. The usual corporcular abnormalities are present.

The lesions generally observed in diseases of the kind are found, but one which the author considers to be pathognomonic is the presence in the abomasum of numerous round or oval ulcers. Similar lesions have been observed in the colon and caecum.

The lymphatic glands are enlarged and oedematous, but sometimes the liquid contained in them is blood tinged, and they may show haemorrhagic infarcts.

Microscopic examination of sections of the spleen shows the presence of gamonts and agamonts.

According to the author there is evidence that the disease is not caused by a single organism, but by two distinct species which are associated with each other. [There seems to be a gap in the text here.] One of these is said to be identical with *Theileria parva*, and the other with *Piroplasma annulatum*. In severe cases more than 90 per cent. of the corpuscles may be invaded. Rounded or ring forms, oval and pear shaped parasites, bacillary forms, flagellated and amoeboid types, and granule-like or anaplasma forms may be found in the blood.

Multiplication may be by simple division, or by division into four, producing the cross forms similar to those described by NUTTALL in *Nuttallia equi*. The former is said to occur in the acute forms of the disease and the latter in the chronic.

The author has made artificial cultures by adding to 9 cc. of sterile defibrinated blood containing the parasite, 1 cc. of distilled water containing 7 per cent. each of sodium chloride and sodium citrate, the tubes being incubated at 25° C.

At about the tenth day anaplasma-like forms make their appearance, and subsequently flagellate forms similar to those found in infected ticks are seen.

It is practically certain that under natural conditions the disease is spread by *Hyalomma aegyptium* and, as only adult specimens of this tick have been found on the animals, the possibility is suggested that the larval and nymphal stages may be passed on other animals.

Details of some experimental inoculations are given.

- (136) NUTTALL (G. H. F.). Experimental Drug Treatment of East Coast Fever of Cattle.—*Parasitology*. 1915. June. Vol. 8. No. 1. pp. 56-87.

In this paper the author publishes details of 18 experimental cases of the disease in which various drugs were tested as to their curative actions. In no case has success been obtained, but the results are published as they may afford some assistance to others working on the same subject.

The following drugs were tried: Congo red, sodium salicylate, trypasafrol, creosote and oil of copaiva, soamin, arsacetin, "606," emetine hydrochloride, mercury salicylate, mercury succinimide, quinine hydrochloride, ethylhydrocupreine, ammonium fluoride, potassium iodide, calcium lactate, and nuclein. All the treated animals

died and showed typical lesions at the post-mortem. They were all infected experimentally by means of *Rhipicephalus appendiculatus*, which had been fed upon infected animals either as larvae or nymphs and were placed upon the experimental animals as nymphs or adults.

- (137) PRIESTLEY (H.). *Theileria tachyglossi* (n. sp.) a Blood Parasite of *Tachyglossus aculeatus*.—*Ann. Trop. Med. & Parasit.* 1915. June 30. Vol. 9. No. 2. pp. 233-238. With 1 coloured plate comprising 16 figs.

The parasite described in this paper was found in the blood of an echidna from the neighbourhood of Townsville, Queensland. As no parasites were discoverable in the blood after an interval of a week the animal was killed and preparations were made from the internal organs. Good films of blood could not be obtained by the wet fixation method, but preparations from the organs treated in that way gave very good results.

The parasite very closely resembled *Theileria parva*, and the same morphological types were found. The majority were rod-shaped and measured 1·8 to 3 microns in length by 0·3 to 0·8 in thickness. On two occasions cross forms were seen. Multiple infection of the cells was very rare.

Bodies resembling Koch's granules were found in the blood in small numbers, but in smears made from the liver, lungs, and spleen they were very numerous. In these organs they were both free and included in endothelial cells and leucocytes.

The echidna from which the parasites were obtained was infested with ticks—*Aponomma decorsum*—and was apparently healthy.

TRYPANOSOMIASIS.

- (138) DELANOË (P.) Des variations du pouvoir infectieux et de la virulence de *Trypanosoma dimorphon* L. et M. Troisième note. [Variations of Infectivity and Virulence of *T. dimorphon* L. and M. Third Note.*]—*Bull. Soc. Path. Exot.* 1915. May. Vol. 8. No. 5. pp. 314-331. With 1 fig.

In this paper the author details at considerable length a large number of experiments in which a strain of *T. dimorphon* derived from a sheep in the first instance was inoculated into a number of different species of animals and then into the guinea-pig and white rat.

The general conclusions may be summarised as follows:—

The guinea-pig and the white rat appeared to possess a complete immunity to the trypanosome whatever method of inoculation was resorted to, whether the strain was taken direct from the original sheep or whether it had been first passed through the kid or goat, or through *Golunda campanae*. The absence of pathogenic power for the white

* For abstracts of the Preliminary and Second Notes, see this *Bulletin*, Vol. 2, No. 1, p. 68, and No. 3, p. 134.

rat is all the more remarkable since the trypanosome is very pathogenic for *Golunda*. It was also found that the strain was incapable of infecting two other species of Muridae, namely, *Arvicanthis niloticus Richardi*, and *Mus concha*.

Cercopithecus callitrichus and an indigenous species of dog also completely resisted inoculation.

- (139) YAKIMOFF (W. L.) & MARMER (R.). Les changements du sang provoqués par l'infection du chien avec le trypanosome des chameaux du Turkestan. [The Alterations produced in the Blood of a Dog infected with the Trypanosome of the Camel in Turkestan.]—*C. R. Soc. Biol.* 1915. June 25. Vol. 78. No. 11. pp. 343-345.

A dog inoculated intraperitoneally with a large quantity of blood containing trypanosomes died on the 34th day.

Trypanosomes appeared in the peripheral blood at intervals. The number of red corpuscles steadily decreased from six millions to about $2\frac{3}{4}$ millions at the time of death.

There was a primary leucocytosis followed by a period during which the number of leucocytes was practically normal with a tendency to leucopenia, and finally a leucocytosis.

The lymphocytes and the neutrophile polynuclears were chiefly concerned in these changes. The former showed a diminution followed by an increase and again a diminution.

- (140) SERGENT (Edm.), LHÉRITIER (A.) & BELLEVAL (G.). Sur le *Trypanosoma marocanum*, n. sp., agent d'une épizootie équine à Casablanca en 1911. [*Trypanosoma marocanum* n. sp., the Cause of an Epizootic among Horses at Casablanca in 1911.]—*Bull. Soc. Path. Exot.* 1915. July. Vol. 8. No. 7. pp. 433-438.

The trypanosome is said to be indistinguishable morphologically from trypanosomes already encountered in outbreaks among horses. It is a monomorphic trypanosome averaging 18 microns in length (maximum 24 and minimum 16) and from 1·5 to 2·5 in width. There is a free portion of the flagellum.

In horses death generally takes place in some weeks. A dromedary appeared to be less susceptible to the infection than to the virus of debab. Goats were susceptible but recovered. Dogs died in about two months. Mice, rabbits and guinea-pigs are all susceptible, death taking place in the first two species in from two to three weeks, and in the last in about twice that time.

Cross-immunity experiments have shown that the trypanosome is distinct from *T. berberum*, *T. equiperdum*, and *T. soudanense*. For this reason the authors propose the name *T. marocanum*.

- (141) LANFRANCHI (A.). Sur le passage des trypanosomes dans le lait. [The Passage of Trypanosomes into the Milk.]—*Bull. Soc. Path. Exot.* 1915. July. Vol. 8. No. 7. pp. 438-442.

The author has carried out a small number of experiments with *T. brucei*, *T. evansi*, *T. rhodesiense*, and *T. gambiense* with the object of ascertaining whether new-born animals can contract infection

through the medium of the milk, whether trypanosomes can be demonstrated by direct examination of the milk, and whether the infectivity of the milk can be demonstrated by intraperitoneal inoculation of rats and mice.

In the first experiment, in which a pomeranian bitch was inoculated with *T. brucei* some hours after whelping, two of the pups died on the 12th day, and although examination of their blood was negative, it was proved to be infective by the inoculation of rats. Similarly, microscopic examination of the milk was constantly negative, but it was found to contain trypanosomes by inoculation.

In another experiment a bitch was inoculated intravenously with blood containing *T. rhodesiense*. None of the puppies born the day prior to inoculation became infected, and trypanosomes could not be discovered in the milk by microscopic examination. One mouse out of several inoculated with milk on different days became infected.

In a similar experiment carried out with the virus of surra entirely negative results were obtained.

In the last experiment, which was carried out with *T. gambiense*, the blood and extracts of the organs of three out of seven puppies proved infective for mice. Microscopic examination of the milk was negative, but one mouse inoculated with it became infected.

Every care was taken to exclude the possibility of the puppies becoming infected by blood from small wounds on the teats.

(142) FIORI (C.) & DELANOË (M. & Mme.). Sur un cas de trypanosomiase constaté chez un cheval à Mazagan, Note Préliminaire. [A Case of Trypanosomiasis discovered in a Horse at Mazagan. Preliminary Note.]—*Bull. Soc. Path. Exot.* 1915. July. Vol. 8, No. 7. pp. 503-515. With 1 plate, comprising 17 figs.

The case recorded in this paper was discovered in an eight-year-old stallion which, so far as could be ascertained, had never served a mare. The primary clinical symptoms were weakness and anaemia, with oedema of the parotid region extending upwards to the ear and two-thirds of the distance down the neck in the jugular furrow. The animal had a good appetite and there was no elevation of temperature. Subsequently, however, other symptoms which suggested trypanosomiasis made their appearance. There was marked emaciation and weakness of the hind quarters. Petechiae appeared on the mucous membranes which became infiltrated. Plaques were observed on the skin, and there was intermittent fever.

Immediately trypanosomiasis was suspected blood examinations were made, but for several days autoagglutination of the red cells only was observed. On the twelfth day trypanosomes were found in the blood in fairly large numbers.

All the parasites seen seemed to have a free flagellum, and in the living state although very active did not move about from place to place in the field.

The blood was examined daily for nearly two months, and trypanosomes were found on four occasions, their appearance coinciding with an elevation of temperature.

The trypanosome was found to be pathogenic for the white rat and mouse, sheep, dog, and rabbit, but according to the authors their experiments are of too recent date to deny the possibility that the last three species may make recoveries.

Pappenheim's method is preferred for the staining of the trypanosome to Giemsa. In specimens stained by this method the blepharoplast appears very small, although it is invariably present. The flagellum is thick and is thrown with the undulating membrane into two or three folds. The free extremity of the flagellum sometimes shows a slight thickening.

The nucleus is sometimes placed transversely in the body, and neither in the original horse nor in any of the experimentally infected animals were any posterior nuclear forms found.

Very distinct granules were present in the body, especially in the anterior half. The posterior end is almost always cut off squarely.

Apparently a rather small number of trypanosomes from the horse have been measured for it is said that the average length of 52 parasites was 26.3 microns. In 7 per cent. found in blood smears made from the horse the trypanosomes had either a very short free portion of the flagellum or there was none at all. The smallest trypanosome measured was 16.8 microns in length, and the longest 33 microns.

In the rat the trypanosomes appeared to be more motile than in the horse, and showed a greater degree of translation.

From the measurements of 36 trypanosomes from the rat it was seen that it was rather larger than in the horse. It was also observed that in the rat about 16 per cent. of the trypanosomes had no blepharoplast, and similar observations were made on parasites present in the blood of infected mice.

The blepharoplast was constantly present in trypanosomes found in the blood of experimentally infected dogs.

The authors believe that the trypanosome is that of debab, but think that immunity tests are required to settle the point. They believe that the infection is brought to Mazagan by camel caravans.

(143) YAKIMOFF (L.). A propos de l'identification des trypanosomes russes. [The Identification of the Russian Trypanosomes.]—*C. R. Soc. Biol.* 1915. June 11. Vol. 78. No. 10. pp. 303-306.

In this short paper the author describes some experiments in which the identity of the trypanosome causing dourine in Russia and of the parasite responsible for the same disease in Algeria was tested by means of cross immunity experiments carried out with sheep. The results indicated that the two parasites were identical.

Further experiments carried out on the same lines with trypanosomes isolated from donkeys and camels at Boukhara showed that these were also identical, and also that the dourine parasites and the Boukhara parasites were different from each other, and that both of these differed from *T. brucei* (Pasteur Institute strain).

- (144) JAXIMOFF (W. J.). [? Yakimoff, W. L.] & WASSILEWSKY (W.). Sur les changements ayant lieu dans le sang du cheval à la suite de l'infection avec le trypanosome des chameaux du Turkestan. [The Changes occurring in the Blood of Horses inoculated with the Trypanosome of the Camel in Turkestan.]—*C. R. Soc. Biol.* 1915. June 11. Vol. 78. No. 10. pp. 309–312.

A foal inoculated subcutaneously with the Boukhara trypanosome died on the 81st day. During the course of the infection observations were carried out regarding the changes occurring in the blood.

It was found that the number of red corpuscles fell from eight and a half million to a little over two million by the 79th day of infection. Agglutination of the red cells, polychromatophilia, and the presence of normoblasts were also observed.

The haemoglobin content of the blood fell more than 40 per cent. In the early stages of the infection the loss of haemoglobin occurred more rapidly than the destruction of the red cells, but in the later stages these processes were reversed. Three stages were observed in the changes in the leucocytes.

In the first stage the relationship of the white corpuscles to the red was 1 to 840. In the second stage it was 1 to 1,240, and in the third stage 1 to 112. The latter was in part due to oligocythemia and in part to leucocytosis.

During the first few days the percentage of lymphocytes rose to about 70 per cent. and it remained at about this level with slight oscillations for some time. During the final stages of the infection it fell to 21 to 31 per cent.

The percentage of the polynuclears varied inversely as the percentage of the lymphocytes.

Arneth's formula.—During the first stage there was a temporary diminution of cells with two nuclei, the number with 3, 4 and 5 nuclei commenced to increase slightly. During the second stage the cells with 4, 5 and 6 nuclei decreased.

At the outset the leucocytolysis was represented by 5·5 per cent., but it reached a maximum of 36·3 per cent.

The alkalinity of the blood became sensibly diminished as the disease progressed.

- (145) LAVERAN (A.). Au sujet d'un *Trypanosoma gambiense* qui, conservé depuis 12 ans chez des animaux, est resté résistant au sérum humain. [A Strain of *T. gambiense* which after being passed through Animals for a Period of 12 Years has not lost its Power of resisting the Action of Human Serum.]—*Bull. Soc. Path. Exot.* 1915. July. Vol. 8. No. 7. pp. 442–446.

The author records a small number of experiments in which the action of human serum was tested upon a strain of *T. gambiense* which had been kept running in animals, mainly guinea-pigs, for a period of twelve years. The results showed that the trypanosome had lost little or none of its power of resisting the destructive action of human serum.

- (146) YAKIMOFF (W. L.). A propos du *Trypanosoma Wrublevskyi*.—*Bull. Soc. Path. Exot.* 1915. July. Vol. 8. No. 7. pp. 431-433.

In this note the author records his change of opinion regarding the identity of the above trypanosome, and states that it is identical with *T. theileri*.

- (147) KOLMER (J. A.). A Method of transmitting Known Numbers of Trypanosomes, with a Note on the Numeric Relation of Trypanosomes to Infection.—*Jl. Infect. Dis.* 1915. July. Vol. 17. No. 1. pp. 79-94. With 1 fig.

The author's method of ascertaining the number of trypanosomes present in a volume of blood is practically the same as that adopted for the enumeration of the total leucocytes. It simply consists in diluting the blood with a liquid which will kill and stain the trypanosomes, and at the same time render the red corpuscles invisible. It is necessary to make a preliminary examination of the undiluted blood so as to get a rough idea of the number of trypanosomes present and thus permit of the calculation of a suitable dilution.

The diluting fluid has the following composition :—

Formalin (40 per cent)	..	..	..	2 cc.
Glacial acetic acid	..	..	..	2 cc.
Distilled water	..	..	..	96 cc.

To these are added after mixing 2 cc. of carbol-fuchsin (Ziehl-Neelsen).

From experiments carried out with rats the author concludes that the injection of a small number of pathogenic trypanosomes lengthens the period of incubation and, in this manner, the duration of life, as dating from the time of infection; but, when the parasites once appear in the peripheral blood, the duration of life is about the same, regardless of whether the animal was originally infected with a large or a small number.

- (148) YORKE (W.) & BLACKLOCK (B.). The Reservoir of the Human Trypanosome in Sierra Leone.—*Ann. Trop. Med. & Parasit.* 1915. July 3. Vol. 9. No. 3. pp. 383-390.

No special effort was made by the authors to ascertain the extent to which sleeping sickness occurred among the natives, but two cases were introduced to their notice.

The first case was a woman who had been infected for at least a year, during which period there had been no definite changes in the state of her health. One of two rats inoculated from her became infected. The other case was the son of the same woman. A single trypanosome had been seen in his blood, but two rats inoculated from him failed to become infected.

It would appear that the disease in Sierra Leone is a very chronic one, and the question of the reservoir is therefore of great importance. The authors have shown that in South Central Africa where trypanosomiasis in man is an acute condition, antelope form a more reliable source of infection for the fly than man, in view of the fact that they

are able to harbour the parasite for a long time in their blood without showing symptoms, and also that their distribution coincides with that of *G. morsitans*, that is to say, it is ubiquitous.

In West Africa, where the disease in man is chronic, and where the transmitting fly is *G. palpalis* which is limited much more closely to the haunts of man, it is probable that man is a more important reservoir than large game. But a trypanosome having all the morphological characters of the trypanosome isolated from the human cases was obtained from the blood of an ox. When maintained in rats and guinea-pigs it was seen that the trypanosome closely resembled *T. gambiense* in its behaviour as well as in its morphological characters, and the authors are of the opinion that it was *T. gambiense*.

Before any opinion can be formed as to the relative importance of man or domestic stock as reservoirs for the infection of the fly information must be gained as to the course of the infection in the animals, and the percentage of them infected.

These points will present some difficulty, but in connection with the first of them it is noted that after an interval of four months the ox did not appear to show any indication of disease. If, as it appears from this, it should prove that the domestic stock are tolerant of infection with the trypanosome the task of discovering the percentage of animals infected will be much greater. It is also pointed out that when prophylactic measures are contemplated the existence of a potential reservoir in domestic stock will have to be taken into consideration.

(149) da COSTA (B. F.), CORREIA DOS SANTOS (A.), FIRMINO SANT'ANNA (J.) & de ARAUJO ALVARES (M. G.). Relatorio final da missão da doença do sono da ilha do Príncipe (1912-1914). (Parte V. Estudo sobre as tripanosomiases da Ilha do Príncipe. [A Study of the Trypanosomes of the Island of Principe] by SANT'ANNA (J. Firmino.)—Arquivos de Hig. e Patol. Exot. 1915. Mar. 30. Vol. 5. pp. 181-256. With 5 plates, 2 figs. & 10 charts.

This is the concluding portion of the final report of Portuguese Sleeping Sickness Commission for the Island of Principe, of which the first part was noticed in Vol. 6 of the *Tropical Diseases Bulletin*, p. 166.

The author only arrived in the island towards the conclusion of the measures taken to exterminate the disease, so that pathological material was scanty and hard to obtain. Particulars are given of the characteristics of four strains of *T. congolense* isolated from three different oxen and a mule, and of one strain of *T. uniforme* from an ox. From three human patients one strain of *T. gambiense* was isolated. Coloured illustrations are given of the morphological peculiarities of all these strains. The four races of *T. congolense* merely varied in their infectivity for animals, their structural characteristics being the same. As shown in a chart (p. 196 of the report) the mean length of all four strains was 15 microns, with extremes ranging from 8 to 21 microns. No. 1 strain was inoculable into all the animals tried, namely rats, guinea-pigs, rabbits, monkeys, dogs and goats; and in rats, guinea-pigs and dogs the infection followed an acutely fatal course, while a monkey and a goat recovered. Inoculation into a cat proved negative.

With No. 2 strain only slight infections were obtained with all the above animals, and with rats and guinea-pigs only after passage through a monkey. No. 3 was inoculable into rats and rabbits, while dogs proved refractory, and with No. 4 only a very light infection was obtained in rabbits and rats.

The single specimen of *T. uniforme* was obtained from an ox that had been eight years on the island and had been originally imported from Cape Verde. Its mean length (chart on p. 205) was 15 microns, with extremes of 11 and 22 microns. The only animals successfully inoculated with it were goats and sheep; one goat dying after 15 days' illness, and one sheep after 19 days. Both animals were at the time badly affected with scab. Laboratory animals proved refractory.

Three examples of *T. gambiense* were obtained from human subjects. Only a few inoculations were made into animals. A strain passed through a monkey had a mean length of 20 microns, whilst the curve of a second strain showed a double peak at 20 and 27 microns (chart p. 222).

A few notes are added as to the blood-sucking insects of Principe. The Glossinae were nearly all destroyed; 342 specimens were, however, dissected, of which number 4·6 per cent. showed flagellates in the mid and hind gut. All attempts in the laboratory to procure infection with these flies in rabbits and monkeys failed. The colour of the Glossinae was exceptionally dark. The island contains two species of *Tabanus*, *congolensis* and *taeniola*. A Herpetomonas, apparently a new species, was plentiful in the hind gut and rectal ampulla of both species, and is figured and described (Plate V). No name is proposed for it. *Stomoxyx nigra* is exceedingly plentiful and is a great affliction to horses and cattle. About 4 per cent. of these insects contained another Herpetomonas (figured in Plate V).

The Culicinae obtained on the island comprised *Toxorhynchites* (? sp. nov.), *Culiciomyia nebulosa*, *Banksinella luteo-lateralis*, *Stegomyia fasciata*, *Anopheles costalis* and *Culicoides milnei*, the latter a very troublesome pest.*

- (150) WEHRBEIN (H.). Conglutination in the Diagnosis of Dourine (Trypanosomiasis of the Horse).—*Jl. Infect. Dis.* 1915. May. Vol. 16. No. 3. pp. 461-465.

The author gives details of the technique adopted in carrying out the tests and summarises the results given by 19 positive sera and 30 negative sera. The general conclusion drawn is that although the method can be used, it is more liable to error through faulty technique and more difficult to carry out than the complement-fixation test.

- (151) LAVERAN (A.). Sur les variétés acentrosomiques artificielles des Trypanosomes. [The Acentrosomic Varieties of Trypanosomes artificially produced.]—*C. R. Acad. Sci.* 1915. Vol. 160. p. 543.

In collaboration with ROUDSKY the author has recently investigated the effects produced by trypasafrol upon the centrosomes of trypanosomes.

* Summarised by Dr. J. B. NIAS.

In mice infected with *T. brucei* and treated with the drug in doses of 0·5 to 1·0 mg. per 20 g. body weight the centrosome entirely disappeared at the 16th passage, and this change persisted in subsequent passages although no treatment was given.

With *T. soudanense*, *T. gambiense*, and *T. rhodesiense* incomplete results were obtained, while *T. lewisi* and *T. duttoni* resisted the action of the drug.

A strain of *T. evansi* has been passed through 459 mice without regaining the centrosome.

The acentrosomic varieties appear to be less virulent than the normal trypanosomes, and the author suggests the possibility of using such varieties for the protective inoculation of animals against the ordinary strains.

- (152) DUBOIS (A.) & van den BRANDEN (F.). La réaction de Boveri dans le Trypanosomiase humaine. [Boveri's Reaction in Human Trypanosomiasis.]—*Bull. Soc. Path. Exot.* 1915. May. Vol. 8. No. 5. pp. 261-266.

Conclusions :—

1. BOVERI's reaction ordinarily occurs in trypanosomiasis during the nervous stage of the disease.
2. It is usually absent or slight in the earliest stage of infection.
3. BOVERI's reaction appears to be attributable to protein substances and possibly to them alone.

- (153) JONES (H. Ll.). The Treatment of Trypanosomiasis in Cattle caused by the *Trypanosoma pecorum*.—*Jl. Comp. Path. & Therapeutics.* 1915. June. Vol. 28. No. 2. pp. 154-166. With 1 map.

In carrying out the first set of observations detailed in this paper the author was working under very unfavourable conditions as the animals were 30 miles from his headquarters, and he had no assistance other than that afforded by untrained natives. The data, in consequence, are not complete, but information of considerable value is afforded by them.

The animals on the rubber and sugar estate where the disease occurred comprised 40 working oxen, 5 donkeys, 4 mules, 1 horse, and 13 goats, and the disease had been in existence for at least three years. In spite of every effort being made no *Glossinae* were ever captured on the estate, and it would appear that the disease was introduced by cattle brought from another part of the territory, although the origin of the infection of these animals was never discovered. Among the flies caught were a number of different species of Tabanidae, Haematopota, Stomoxys, and one species of Hippobosca.

Diagnosis was based upon the examination of fresh blood smears and specimens stained with Giemsa, and it was found that 20 cattle, 3 donkeys, 1 mule, and 1 horse were infected. Five cattle had died, showing symptoms strongly suggestive of trypanosomiasis.

It was decided to treat the sick oxen only, but before this could be arranged four of them had died, and the infected mule had been killed.

Prior to the commencement of treatment the temperatures of the isolated cattle were taken twice daily, and it was noted that the evening temperature was almost invariably higher than the morning temperature.

The first treatment adopted was the intravenous injection of an average dose of 1 grammme of antimony potassium tartrate dissolved in 20 cc. of boiled water and allowed to cool to the body temperature. On taking the animals' temperatures on the five days following the injections it was found that there was a considerable improvement both as regards the height of the morning temperature and the difference in the two daily readings.

Blood examinations were carried out four hours, 24 hours, and five days after the injections, and in every instance the result was negative. There was also observed a general improvement in the condition of the animals.

The second part of the treatment consisted of giving on alternate days for a period of three weeks increasing doses of arsenic. During the first week the animals received 1 grammme, during the second week, 1.5 g. and during the third week 2 g. The drug was administered either wrapped in paper and given by hand, or mixed with chopped grass and mealie meal. No toxic symptoms were ever observed. After an interval of three weeks the treatment with arsenic was repeated. It had been intended to give another injection of emetic, but the author was unable to go to the estate.

Two and a half months after the first treatment a second visit was paid. Examination of the blood of all the animals revealed the presence of very small numbers of granular trypanosomes in three of them. At this date the whole of the treatment was recommenced.

About three weeks after four of the animals had trypanosomes in their blood. In two they were numerous and in two scanty. Two of those which had shown granular trypanosomes on the previous occasion were negative at this test. In spite of this the condition of all the animals was satisfactory, and 50 per cent. of them were fat.

A fortnight later those animals which had not shown trypanosomes were put to work, working half a day for a week and then resting for a week, and for a month this programme was followed.

After a further interval of about a fortnight another blood examination was made and trypanosomes were found in two animals which had shown them at the previous test.

During the two following months the animals, except for the two infected ones, did their half-day's work regularly. The two infected animals received a course of arsenic. Three months later no trypanosomes could be found in any of the treated animals.

Of the 20 oxen not treated four died with typical symptoms, and it is quite possible that these and perhaps other animals were actually infected at the time of the first examination, but escaped detection. Eventually seventeen of them died, and they thus served usefully as controls.

Two years and nine months after the first treatment the whole of the sixteen surviving animals which had been treated were still working and had been doing so the whole time.

In February, 1913 an outbreak occurred in the neighbourhood of Beira in which over 1,000 animals died within six months.

Treatment was carried out on the same lines as in the previous outbreak on 498 infected animals. Within six weeks after the commencement of the treatment 49 animals had died. The second injection was given about two months after the first, and as it appeared to be a case of kill or cure the doses were doubled. The animals were in such poor condition that 16 died within a day as a result of the injection. By the end of September, about four months after the treatment had been started, the herd numbered 309 animals, but many were still showing marked clinical symptoms. Forty-five of these received a fresh injection but no more arsenic, with resulting improvement in their condition.

Early the following year 95 bullocks were sold in fat condition, but during the course of the year seven or eight animals were killed as they appeared to have failed to make a recovery, and were a source of danger.

At the beginning of the following year there were 157 animals in the herd and all looked perfectly healthy. A number of animals had been disposed of during the interval, but no deaths had occurred.

A small number of experiments carried out with arsenophenyl-glycin gave very unsatisfactory results. The dose used was 1 gramme per hundredweight dissolved in 1 litre of warm distilled water, and it was administered intravenously. Three injections were given with intervals of five and eight weeks, but although there was a rapid disappearance of the trypanosomes from the blood they always reappeared.

Eight animals were treated with soamin, animals weighing half a ton were given as much as 120 grains dissolved in 30 cc. of distilled water and injected subcutaneously. Large single doses were found to be preferable to small repeated doses. Seven cattle and a donkey were submitted to the treatment, and none died. The cattle improved very greatly in condition, but the donkey remained weak. An objection to this treatment was the expense.

The author gives an outline of the sequence of events in the various outbreaks and the circumstances lead him to think that Glossinae were not responsible for the transmission of the infection from herd to herd, because none could be found, in spite of a long continued search on the flats where the animals were principally pastured and where they came into close contact with each other. *G. morsitans* was found in outlying forest land. He believes that Tabanidae and Hippoboscidae were concerned in the spread of the disease, as flies of these genera were present, sick and dying animals being literally covered with them.

Certain conditions are however necessary for the transmission. The animals must be in very close contact with each other, and there must be very large numbers of the various biting flies. The author believes that the transmission is a mechanical one.

- (154) van SACEGHEM (R.). *Expériences sur le traitement des trypanosomiases animales.* [Experiments regarding the Treatment of Animal Trypanosomiases.]—*Bull. Soc. Path. Exot.* 1915. May. Vol. 8. No. 5. pp. 339-347.

The experiments recorded in this paper were carried out at the School of Tropical Medicine at Brussels, and the drugs used were

atoxyl and emetic, either alone or in conjunction with each other. The two strains of trypanosomes utilised in the experiments were *T. congolense* and *T. brucei* var. Uganda. The experiments were carried out almost exclusively with guinea-pigs.

The general results obtained indicate that subcutaneous injections of either of the drugs mentioned are of no value for the treatment of guinea-pigs infected with *T. brucei* or *T. congolense*.

Rather better results are claimed for treatments involving the use of atoxyl and emetic together.

In view of the irritant effect produced by emetic when injected under the skin of large animals, and the difficulties associated with its intravenous injection, the author recommends the intramuscular method for the administration of this drug. It is said that with this method there may be produced weakness, acceleration of the pulse, and other symptoms of lowered vitality; these, however, pass off within 24 hours.

When the drugs are used in conjunction with each other they should be administered separately.

The author thinks that relapses are due rather to trypanosomes in certain parts of the body, such as the bone marrow, escaping the action of the drugs than to specially resistant forms, and proposes to overcome the difficulty of reaching them by administering very large doses, and to counteract the systematic effects of these doses by administering atropine sulphate or caffeine.

In an appendix the author gives brief details of one case of trypanosomiasis in a buffalo (*T. cazelboui*) at Zambi which was treated by intramuscular injections of emetic associated with subcutaneous injections of atoxyl and improved greatly in condition.

LEISHMANIASIS.

(155) YAKIMOFF (W. L.). Contribution à l'étude des Leishmanioses de l'homme et du chien dans le Turkestan russe. [Human and Canine Leishmaniasis in Russian Turkestan.]—*Bull. Soc. Path. Exot.* 1915. July. Vol. 8. No. 7. pp. 474-503.

The author finds that in Turkestan there appears to be some connection between the number of cases of the disease occurring in the dog and in man in the various districts, the percentage of cases in the two species bearing a more or less constant relation to each other.

Of twelve cases of the disease in children in which the author was especially interested seven were in close contact with dogs, one with a cat, in one dogs were in the neighbourhood of the child, but there was no actual contact, and in three there were no dogs in the house.

In smears of the intestinal contents of a flea caught on the cat the author has found organisms in the post-flagellate phase similar to those noted by BASILE, SANGIORGI and others, and in *Ctenocephalus canis* he has found parasites indistinguishable from leishmania.

The parasite occurring in Turkestan is indistinguishable from the Indian and Mediterranean parasites, and like those it may be either free or enclosed in cells of various kinds. On one occasion in a child the author found a leishmania in a red corpuscle.

An observation made in 1912 on material obtained from Tunis but not published has been confirmed in Turkestan, namely, that forms suggesting, if not representing, schizogony may be found both free and enclosed in cells in smears made from the spleen in severe cases.

The author has been able to infect mice from children and to infect dogs and cats from such mice.

With regard to the question as to the identity or otherwise of the diseases caused by parasites of this genus in the various countries, the opinion is expressed that they are all identical, and that the diseases of man and the dog are also the same. In consequence of this dogs may play an important part in the transmission of the disease, and contact with dogs is always a source of danger to man.

Material has been obtained from about 1,000 dogs, and examination shows that practically 24 per cent. are infected, and it appears to be established that the disease in dogs shows a seasonal variation, the number of fresh infections increasing during the early part of the summer.

An account is given of the clinical characters of the disease in dogs, but the author expresses the view that in the majority of cases no special symptoms are seen. It was found experimentally that the disease may last for three years or more.

The most constant lesions were enlargement of the spleen and red colouration of the bone marrow, but both of these lesions are not observed in every case, and enlargement of the spleen alone is not very significant.

- (156) LAVERAN (A.). *Sur une culture de Leishmania donovani souillée par un champignon.* [A Culture of *Leishmania donovani* contaminated by a Mould.]—*Bull. Soc. Path. Exot.* 1915. July. Vol. 8. No. 7. p. 429.

The author records that some tubes of simplified Novy medium sown out with *L. donovani* gave good growths in spite of the presence of a mould. The contamination was got rid of by placing in the tubes five drops of a 1 per cent. solution of caustic soda. Four days later the moulds had disappeared, and on subcultures being made the leishmania was obtained in a state of purity.

- (157) LAVERAN (A.). *Nouvelle contribution à l'étude des infections expérimentales de la souris par la Leishmania tropica.* [Further Contribution regarding the Experimental Infection of the Mouse with *Leishmania tropica*.]—*Bull. Soc. Path. Exot.* 1915. June. Vol. 8. No. 6. pp. 363-369.

In this paper the author records the results of his examinations of sections of the testicles of mice inoculated with *L. tropica*. From these it appears that the epithelium of the testicles is never involved, but that the connective tissue surrounding the testicle which is at the same time infiltrated with embryonic cells contains the parasite in large numbers. In advanced cases the testicular substance may be invaded by connective tissue containing the parasite, and this may lead to atrophy of the organ.

The author again draws attention to the development of small superficial abscesses containing Leishmania on the abdominal wall of mice inoculated into the peritoneum, and makes special mention of one case in which there was developed a periarthritis of the joints of the hind legs. This mouse showed at the same time a septicaemia following on partial necrosis of the lesion of the testicles.

- (158) YAKIMOFF (W. L.). *De la période d'incubation chez les animaux infectés par les Leishmania.* [The Period of Incubation in Animals infected with Leishmania.]—*Bull. Soc. Path. Exot.* 1915. July. Vol. 8. No. 7. pp. 430-431.

Summarising briefly the statements published by various observers, the author shows that in dogs the period of incubation after experimental infection is generally about 12 days, and that in mice the period may be very short.

A dog of about two months old was inoculated intraperitoneally with an emulsion of the organs of another dog which had been infected with a human strain of the parasite which had been used to infect mice successfully. The material used was very rich in parasites. On the third day the dog died. The serous membrane of the small intestine was very congested and parasites were found in small numbers in smears from the liver and the spleen. The bone marrow appeared to be free from parasites.

It is suggested that the short period of incubation in this case may have depended to some extent upon the number of parasites injected, the age of the animal inoculated, and the origin of the virus.

SPIROCHAETOSIS.

- (159) ZINSSER (H.) & HOPKINS (J. G.). *Antibody Formation against Treponema pallidum—Agglutination.*—*Jl. Experim. Med.* 1915. June. Vol. 21. No. 6. pp. 576-583. With 3 plates comprising 5 figs.

Summary:—

"It has been shown by our experiments that the serum of rabbits treated with emulsions of *Treponema pallidum* contains agglutinating substances.

"Normal rabbit serum also possesses agglutinating power for this organism, but, as in the case of normal bacterial agglutinins, to an extent very much inferior to that possessed by the sera of immunized animals. Normal human sera will agglutinate similar pallidum emulsions, as will the sera of certain syphilitic patients with positive Wassermann reactions. Whether or not there is a quantitative difference of diagnostic value between the sera of normal human beings and those of syphilitics remains to be seen.

"The sera of rabbits immunized with strain A agglutinate Noguchi's strain 9 in dilutions as high as 1 to 500.

"We regard as the most important result of these experiments the demonstration of definite antibodies in the circulation of animals treated with dead emulsions of *Treponema pallidum*. Since it is our belief* that

* ZINSSER (H.). *Jl. Experim. Med.*, 1913. Vol. 18, p. 219.

the agglutinating effect is due to an antibody essentially the same as that which produces bactericidal, precipitating, and opsonic effects, i.e., that there is probably one type of antibody only, we believe that the demonstration of agglutinins establishes the fact that in syphilis as in bacterial diseases the host responds by the formation of antibodies or sensitizers specific for the treponema.

"Spirocheticidal experiments with these sera, both *in vitro* and *in vivo*, are in progress."

- (160) LAUNOV (L.) & LÉVY-BRÜHL (M.). *Sur la résistance des poules à l'infection par la Spirochaeta gallinarum après thyroïdectomie ou splénectomie.* [The Resistance offered by Fowls to Infection by *Spirochaeta gallinarum* after Thyroidectomy and Splenectomy.—*Ann. Inst. Pasteur.* 1915. May. Vol. 29. No. 5. pp. 213-220.

The fact that enlargement of the thyroid glands and of the spleen is observed in both natural and experimental spirochaetosis in birds prompted the authors to investigate the question as to whether these organs play any part in the resistance offered by birds to infection, and in the production of antibodies, and whether their removal would alter the course of the disease in any way.

A number of series of experiments in connection with removal of the thyroid glands are briefly recorded. From these it appears that removal of the thyroids does not reduce the degree of resistance offered by birds to infection, when the attempt to infect is made from one to 16 days after the operation. Partial or complete removal of the parathyroids also appeared to have no effect.

It was further shown that the protective power possessed by the serum of recovered birds from which the glands had been removed was not lowered in any way.

In birds from which the spleen had been removed prior to their inoculation it was found that spirochaetes appeared in the blood earlier than in the controls, and also that parasites were far more numerous in the blood of birds that had been operated upon. A further fact that was established is that the duration of the invasion of the blood is longer than in birds not derived of their spleens. These phenomena are not accompanied by any increase in the severity of the clinical manifestations of the infection, in fact the symptoms are often less severe in animals upon which splenectomy has been performed.

Removal of the spleen does not affect the production of protective substances.

PROTOZOA.

- (161) LAWSON (Mary R.). *Adult Tertian Malarial Parasites attached to Peripheral Corpusecular Mounds. The Extracellular Relation of the Parasites to the Red Corpuscles.*—*Jl. Experim. Med.* 1915. June. Vol. 21. No. 6. pp. 584-592. With 4 plates comprising 109 figs.

In this paper the author repeats her views regarding the position of the malarial parasites in relation to the red corpuscles, and a large number of figures taken from photographs of stained preparations are reproduced to support the view.

- (162) PEREKROPOFF (G. J.). Ueber Kulturen der Plasmodien des tropischen Flebers (*Malaria tropica*). [The Cultivation of the Plasmodium of Tropical Malaria.]—*Arch. f. Protistenk.* 1914. Nov. 3. Vol. 35. No. 2. pp. 139–153. With 3 coloured plates comprising 116 figs.

The author claims that by a technique based upon that of BASS and JOHNS he has been able in two cases out of seven to obtain not only schizogony but also sporogony with the development of sporocysts in the red corpuscles. The modifications of BASS and JOHNS' method adopted are as follows:—

1. The quantity of dextrose solution added to the blood was 0·4 cc. to 10 cc.
2. The "blood serum" was inactivated by heating it to 41° C. for half an hour and then for a similar period to 42° C.
3. For transplantations "blood serum" inactivated at 55°–56° C. was used.
4. The transplantations were made 5 or 6 hours after the normal segmentation had taken place.
5. The material was transferred to a rich medium composed of 0·04 cc. of 50 per cent. dextrose or maltose solution and 0·2–0·4 cc. of "blood serum" or Loeke's solution.
6. The proportion of red corpuscles containing parasites to fresh red corpuscles was as 2:5 to 3:5.
7. The blood containing the parasites was not centrifuged in any instance; thus injury to the parasites was avoided.

- (163) MATHIS (C.) & HEYMANN (P.). La réaction de Wassermann dans le paludisme. [Wassermann's Reaction in Malaria.]—*Bull. Soc. Path. Exot.* 1915. May. Vol. 8. No. 5. pp. 258–259.

The authors have tested serum from 21 cases of malaria of different types, but have not obtained positive results in any instance.

- (164) WENYON (C. M.). The Pigmented Parasites of Cold-Blooded Animals, with some Notes on a Plasmodium of the Trinidad Iguana.—*Jl. Trop. Med. & Hyg.* 1915. June 15. Vol. 18. No. 12. pp. 133–140. With 1 plate comprising 16 figs.

The first portion of this paper contains a short history of the discovery of pigmented parasites of cold-blooded animals. The author then passes on to a consideration of the classification of these parasites and concludes that the organisms should be placed in two genera according as gametocytes and schizonts or gametocytes alone are to be found in the peripheral blood, as is the case with the malarial parasites of birds.

A brief description of the various parasites that have been found in the red blood corpuscles of cold-blooded animals is given. This includes six parasites found in the blood of lizards, all of which belong to the genus *Plasmodium*, and five species from tortoises belonging to the genus *Haemoproteus*. It is doubtful whether these are all distinct species. A description is also given of two parasites belonging to the genus *Haemoproteus* which have been found in the blood of snakes. It is probable that these belong to a single species.

The paper also contains a description of a parasite found in films of blood made from the Trinidad iguana. The plate shows young forms, schizonts in different stages of division, and parasites that are considered to be gametocytes. In view of the occurrence of these forms in the blood the parasite must be considered to be related to the genus *Plasmodium*.

- (165) YORKE (W.) & BLACKLOCK (B.). Notes on Certain Animal Parasites of Domestic Stock in Sierra Leone.—*Ann. Trop. Med. & Parasit.* 1915. July 31. Vol. 9. No. 3. pp. 413-420.

The authors examined 143 head of cattle and found trypanosomes in 19, but the number actually infected was probably much higher than this as in most cases an examination of a single preparation of fresh blood was all that could be done. The bulk of the infected animals were found among those brought down to Freetown for slaughter. The probable explanation of this fact was that the natives brought in the animals for slaughter when it was observed that they were losing condition. The following trypanosomes were found: *T. congolense* eleven times, *T. vivax* twice, a double infection of these two five times, and *T. gambiense* once.

The blood of ten dogs was examined with negative results, but one of the animals was proved to be infected with *T. congolense* by the inoculation of rats.

No trypanosomes were found in the blood of seven sheep and seven goats.

Four hundred specimens of *Glossina palpalis* caught on Cape Light-house Peninsula were examined and trypanosomes were found in twenty-one of them. In no instance were the salivary glands infected, but from the distribution of the infection in the flies it would appear that fifteen were infected with *T. vivax*, four with *T. congolense*, and the remaining two with a trypanosome belonging to the *congolense* or *gambiense* group. This point could not be settled as the development of the trypanosomes in the flies was not complete.

In about 5 per cent. of the animals examined parasites which were undoubtedly *Babesia bigemimum* were discovered. In from 20 to 30 per cent. of the animals another parasite was present in the red blood corpuscles, and this the authors think there can be no doubt was *Theileria mutans*. In some of the animals 1 to 2 per cent. of the corpuscles were invaded, while in others only an odd parasite could be found. No "blue bodies" were found in the blood or in smears from the organs of six infected animals.

The only species of ticks encountered were *Boophilus australis* and *Amblyomma variegatum*.

- (166) FANTHAM (H. B.). Insect Flagellates and the Evolution of Disease, with Remarks on the Importance of Comparative Methods in Study of Protozoology.—*Ann. Trop. Med. & Parasit.* 1915. June 30. Vol. 9. No. 2. pp. 335-348.

"The significance of the herpetomonad stage of *Leishmania*, of the recent announcements that such stages occur in man, and of the presence of natural herpetomonads in other vertebrates (for example, mice), are discussed. It also recalled that insect herpetomonads can invade and live in plant-tissues.

"The experiments on the introduction into different vertebrates of various species of *Herpetomonas* and *Oriithidia* parasitic in insects by Laveran and Franchini, using mammals, and by Fantham and Porter, using both warm- and cold-blooded vertebrates, are summarised and discussed.

"It is inferred that the various leishmaniases are due to a herpetomonad of invertebrates which, under different conditions of environment, produces pathogenic effects in very varying degrees in different vertebrates, from zero, as in the mice described by Dutton and Todd in 1903, to high mortality as in Indian kals-azer, and probably zero again in cold-blooded hosts. It is also a flagellate which can probably live in invertebrates not already recorded as being infected. A human reservoir of leishmaniasis may occur in some places, while warm- and cold-blooded vertebrates may also function as the same.

"It is highly probable that the so-called cultural herpetomonad stages of trypanosomes were really cultures of scanty herpetomonad infections co-existing with trypanosome infections."

- (167) FANTHAM (H. B.) & PORTER (Annie). On the Natural Occurrence of Herpetomonads (Leptomonads) in Mice.—*Parasitology*. 1915. June. Vol. 8. No. 1. pp. 128-132. With 7 text-figs.

The authors refer to some observations regarding the occurrence of herpetomonads in the blood of mice which were originally made by them in 1909, and which were repeated in 1911 and 1912.

A description of the parasite is given and the original statement by DUTTON and TODD regarding the occurrence of parasites of this genus in the blood of mice in the Gambia is reproduced in full.

The conclusions drawn are as follows:—

- "1. Natural herpetomonads (or leptomonads) occur in mice.
- "2. The origin of the infection is to be sought in a flagellate of an ectoparasite of the mouse. This flagellate is very probably *Herpetomonas pattoni*, a natural or specific parasite of fleas (especially rat fleas), which protozoon can adapt itself to life in the blood of mice.
- "3. Herpetomonads have been recorded from rat fleas, dog fleas and human fleas. Probably the flagellates are varieties of one species, *H. pattoni*, which can live in the blood and certain internal organs of rats, mice, dogs, and man."

- (168) RODHAIN (J.). Herpetomonas Parasites de larves d'Oestrides cavigoles. [Herpetomonas Parasitic in Larvae of Oestridae].—*Bull. Soc. Path. Exot.* 1915. June. Vol. 8. No. 6. pp. 369-372. With 8 text figs.

A. Herpetomonas of larvae from *Bubalis lelwel jacksoni*. These are large lancet-shaped parasites which have a thick flagellum projecting from the anterior extremity of the body, and in the fresh state are capable of active movement. The nucleus is centrally placed and round or oval in shape. When undergoing division it appears to be composed of a number of chromatic granules. Anterior to the nucleus there is a large oval blepharoplast. The flagellum starts at a small but distinct basal granule placed anterior to or beside the blepharoplast. The first portion of the flagellum is formed by a thick rhizoplast and this is succeeded by the flagellum proper which is covered by a thin periplastic membrane. Even in the resting condition the flagellum is invariably double, and during the process of division two distinct double flagella can often be seen.

In the cytoplasm very slender axostyles can be seen extending from the basal granules to the posterior somewhat pointed extremity of the body. These appear to intercross in front of and behind the nucleus.

The parasites measure from 60 to 90 microns in length including the flagellum, and from 3·6 to 6·25 in width.

The parasite has only been found in the intestinal contents of the larvae, but it has been found in all five species of oestruus larvae occurring in the sinuses of Bubalis. No true cyst forms have been seen, nor has the parasite been found in the adult fly.

B. Herpetomonas of the larvae of *Rhinoestruus nirvaleti*, Rodh. and Beq. in *Potamochaerus porcus*. Six larvae were obtained and all were infected. The herpetomonas was very similar to that just described, but it was rather smaller and the double flagellum of the adult forms was rather less distinct. Encysted forms of this species were also observed. In these the blepharoplast was placed very close to the nucleus and was possibly fused with it, while the flagellum was reduced to its intracytoplasmic part.

- (169) LAVERAN (A.) & FRANCHINI (G.). Au sujet d'un Herpetomonas de *Ctenopsylla musculi* et de sa culture. [A Herpetomonas of *Ctenopsylla musculi* and its Cultivation.]—*Bull. Soc. Path. Exot.* 1915. May. Vol. 8. No. 5. pp. 266-270.

The parasite referred to occurs in the following forms in smears of the intestinal contents of the mouse flea stained with Giemsa. The commonest form is the leishmaniform parasite which measures from 2 to 4 microns in length by 1 micron in width. They are oval and generally possess a centrosome and a nucleus.

There also occur larger forms which measure from 5 to 15 microns in length by 1·5 to 2 in width. These have one rounded extremity and one pointed. The centrosome is placed towards the rounded end, but may be quite close to the nucleus. These parasites appear to be a more advanced stage of those first described.

Large rosette clumps are frequently seen.

The other form in which the parasite occurs closely resembles the preceding one, but there is a short flagellum which takes origin at the centrosome and passes out of the body at the rounded end. Parasites of this type are exceedingly rare.

Encysted forms have never been found in the faeces.

A positive result was obtained in one culture tube out of six, the medium being rabbit blood-agar, incubated at 25-26° C.

In cultures, as in the intestinal contents, leishmaniform parasites are by far the more numerous, flagellated organisms being distinctly rare. The morphology of the parasites in culture resembled that of the intestinal forms, but as a rule they appeared to be considerably larger.

- (170) SCHULTZ (C. H.). Coccidiosis in Cattle and Carabaos.—*Jl. Infect. Dis.* 1915. July. Vol 17. No. 1. pp. 95-108.

In carrying out rinderpest investigations the author encountered a number of "irregular cases" which eventually proved to be cases of coccidiosis, or as the author prefers to call it coccidian gastro-enteritis.

Great emphasis is laid upon the difficulty of differentiating coccidiosis from rinderpest, and in the paper the information regarding the two diseases is somewhat curiously intermixed.

The author states that in one case of coccidiosis which showed lesions at the post-mortem identical with those of rinderpest, "young forms of the schizogonous type could be found in countless numbers in scrapings from the ulcerated abomasum" and the whole of the intestinal tract.

He also states that by careful laking and centrifugation of blood taken from an animal recovering from a severe attack of coccidian dysentery spores can be obtained in appreciable numbers. It is said that coccidia can be found more easily in the urine than in the faeces, and that in the urine they appear under the immersion lens as "dense small coccoid bodies," the larger forms "being apparently held back by the kidneys."

"When spores are first liberated they are quite large, about one-half the size of an erythrocyte. As the spores become more developed, they show a denser capsule and become smaller."

The author states that from his "own observations in rinderpest experiments it would appear, in view of the peculiar methods by which coccidia can be divided into most minute organisms (Zublein, 1908), that one part of their life-cycle is passed in the blood vascular system, and that their rapid multiplication in most minute forms produces the haemolytic form of the disease. This is superseded, if the host lives, by the diarrhoeal form, the latter being necessary to re-infect other hosts and to transfer the contagion from one place to another."

"We cannot deny that acute coccidiosis has invariably resulted from rinderpest inoculations. Our last cases (3,694 and 3,714) died from coccidian gastro-enteritis of the most severe type after receiving a sub-cutaneous injection of 5 cc. of rinderpest blood. Since we have been able to recognise coccidiosis, we have never found a case of rinderpest without the presence of these organisms in great numbers."

"Of four guinea-pigs that were inoculated with blood from spore-bearing cattle, two died [about 7 weeks later] from coccidian dysentery, one died from pneumonia, and one is still alive and doing well."

"A good illustration of nature's method of producing immunity against protozoa is found in our southern states, where cattle, inoculated by ticks with piroplasmosis for generations, have acquired a very high resistance."

- (171) WICKWARE (A. B.). Is *Leucocytozoon anatis* the Cause of a New Disease in Ducks?—*Parasitology*. 1915. June. Vol. 8. No. 1. pp. 17-21. With 3 plates.

The disease in question runs a rapid and fatal course, about 70 per cent. of the affected birds succumbing. The first symptom is an impaired appetite, but the preliminary symptoms are not very marked.

In some cases the birds succumb during the first paroxysm, while in others there are exacerbations at intervals without producing a fatal result.

One of the attitudes taken up by the birds when in a comatose condition is with the head bent over backwards and resting on the back. If birds in this condition are roused they show evidence of intense excitement. The power of balance is lost, and they roll over and over, and the head is waved about in an extraordinary manner. In some cases the neck is turned completely round, the head resting on the ground in an upright position. A fairly constant symptom

is a purulent ophthalmia. Recovered birds are very stunted in their growth.

The causal agent of the disease has not been determined, but in the course of his investigations the author discovered a leucocytozoon which does not appear to have been described before, and which is the subject of this preliminary report.

Parasites were found in all the diseased ducks and they were present in smaller numbers in recovered birds. Contact birds which showed no symptoms were apparently not infected with the organism.

The predominant form was a spindle-shaped structure measuring 35 to 60 microns in length by 10 in width. There was an elongated or irregular-shaped nucleus, and a dark "chromatic band" running along one border of the parasite. Further study is required to settle definitely whether the organism is motile.

The only lesion found was acute haemorrhagic inflammation of the intestine immediately behind the caeca. There was constantly an increase in the number of eosinophile leucocytes in the blood.

A limited number of inoculation experiments were carried out. In one of these two gamete forms were observed on the seventh day after intraperitoneal inoculation with blood. In these parasites the chromatic band was present, but no nucleus could be discovered. Three days later typical gametes with nuclei were found. These forms persisted for a few days and then disappeared. No mature forms were present in the smears. White rats appeared to be refractory.

HELMINTHS.

- (172) YORKE (W.) & BLACKLOCK (B.). Ankylostomiasis in Dogs in Sierra Leone. (Being the Fifth Report of the Thirty-second Expedition of the Liverpool School of Tropical Medicine, 1914-1915). —*Ann. Trop. Med. & Parasit.* 1915. July 31. Vol. 9. No. 3. pp. 425-427. With 4 text-figs.

Of seven dogs examined by the authors all were found to be infected with ankylostomes, but two species of parasites were encountered—*Ankylostoma caninum* and *Ankylostoma ceylanicum*. These species are easily distinguished by the arrangement of the teeth. In the former there are three pairs of ventral teeth, and in the latter one large ventral pair and a second very small pair close to their base.

The rays of the lateral lobes of the caudal pouch are the same in the two species, but in the median ray of the dorsal lobe there is a slight difference. In both species the ray is bifurcated in the terminal third, each branch being tridigitate at the extremity. In *Ankylostoma caninum* the digitations are separated from each other by mere notches, while in *Ankylostoma ceylanicum* the outer notch is quite deep and cleft-like. The males measure about 6-7 mm. and the females from 7 to 14 mm.

No opportunity offered to ascertain whether *Ankylostoma ceylanicum* occurs in man in Sierra Leone.

- (173) HALL (M. C.). A Note on *Syngamus Laryngeus* from Cattle in the Philippine Islands.—*Amer. Jl. Vet. Med.* 1915. June. Vol. 10. No. 6. pp. 395-396. With 3 text-figs.

The parasite found in the Philippine Island is identical with that described by RAILLIET save that the males are a little shorter and the females a little longer. The males measure 2·75 to 3·1 mm. and the females 9·7 to 12 mm.

Among the specimens examined were found males that were attached to females by means of the buccal capsule. In one instance this was the only manner in which the male was attached to the female, and in another case the male was attached to the female by the caudal pouch and to another female by the buccal capsule. There is no record of this worm producing any pathological effects in the Philippines.

- (174) MITZMAIN (M. B.). An Experiment with *Stomoxys calcitrans* in an Attempt to transmit a Filaria of Horses in the Philippines.—*Amer. Jl. Trop. Dis. & Prevent. Med.* 1915. June. Vol. 2. No. 12. pp. 759-763. With 1 plate.

Two hundred newly emerged *Stomoxys* were allowed to bite a horse whose blood always contained active filariae and on the day upon which the flies were fed contained as many as 12 to a single field under a low power. All but three of the flies fed. On the following day 170 of them again engorged themselves with blood containing a moderate number of active embryos. They were kept till the fourth day following without feeding and then they were used during a period of about five weeks, until there were only four flies left, to feed upon four horses at varying intervals. These four horses had been used in a surra experiment and had failed to become infected, and a daily examination of their blood during a period of two months had not revealed the presence of any filariae.

As a control 200 other laboratory-bred flies were allowed to feed on a healthy horse, and the daily death-rate noted. When the death-rates of the two sets of flies were compared it was seen that more than twice the number of deaths occurred among the filaria-fed flies during the first ten days than among the control flies, but that after this there was no marked difference in the death-rate in the two series.

In one instance the gut-contents of a fly that had ingested infected blood was examined, and one of the filaria found was being ingested by a polymorphonuclear leucocyte. It is suggested that this may be the explanation of the non-development of a number of the embryos ingested by the flies.

From the fifth to the eighth day after ingesting the infected blood 31 flies were dissected. In three of these larval worms were found embedded in the thoracic muscles. Flies dissected after the eighth day showed no evidence of having been invaded by parasites.

"During the entire period of the experiment the five horses were kept in individual stalls in a screened stable. The blood of the four healthy animals was examined two to three times weekly for sixty days after the final fly application. They were also examined a month later, when all appearances of blood infection were absent."

- (175) MEGGITT (F. J.). A new Species of Tapeworm from a Parakeet, *Brotogeris tirica*.—*Parasitology*. 1915. June. Vol. 8. No. 1, pp. 42-55. With 2 plates comprising 19 figs. & 4 text-figs.

The author gives in a tabular statement the distinguishing features of the species belonging to the genus *Cotugnia* already described, and shows that the parasite described in this paper differs from these in so many details that a new species is justified for it. For this new species he suggests the name *Cotugnia brotogeris*. The following description is given under the heading "Specific diagnosis."

"*Cotugnia*: 75 mm. long by 2 mm. broad. Head: 0·42 mm. in diameter, 0·45 mm. long, with retractile rostellum 0·15 mm. in diameter, armed with a crown of numerous hooks arranged in a double row. Hooks [of the *Davainea* type], 0·012 mm. long. Suckers oval, unarmed, 0·081 mm. in diameter. Neck absent. Segments trapezoidal and imbricate. Genital organs double in each segment, genital pore situated at the anterior third of the lateral margin. Male and female canals pass dorsal to the excretory system.

"*Musculature*: Three longitudinal muscle layers alternate with three transverse layers.

"*Male genitalia*: Testes numerous in a double row, occupying the centre of the proglottis and extending laterally beyond the excretory canals. Cirrus pouch not reaching the longitudinal excretory canal.

"*Female organs*: Yolk-gland posterior to ovary. Receptaculum seminis spherical. Ovary strongly lobed. Yolk-gland compact, little lobed. No persistent uterus present. Eggs enclosed in parenchymatous capsules, each containing several eggs. Egg has three membranes.

"*Life history*: Unknown.

"*Host*: *Brotogeris tirica*.

"*Locality*: Brazil."

BITING FLIES.

- (176) YORKE (W.) & BLACKLOCK (B.). Notes on the Bionomics of *Glossina palpalis* in Sierra Leone, with Special Reference to its Pupal Habitats. (Being the First Report of the Thirty-second Expedition of the Liverpool School of Tropical Medicine, 1914-1915).—*Ann. Trop. Med. & Parasit.* 1915. July 31. Vol. 9. No. 3. pp. 349-362. With 7 plates & 1 map.

The observations recorded in this paper were carried out during a visit to Sierra Leone, the primary object of which was to fix upon a site suitable for the erection of a permanent laboratory.

Among the subjects into which investigation was made was the bionomics of *Glossina palpalis*, and Cape Lighthouse Peninsula which lies at the mouth of the Sierra Leone River, and of which a somewhat detailed description is given, was considered to be a suitable place at which to start investigations.

Success immediately followed a search for pupae, which were found on or just below the surface of the ground in the interior of a hollow tree. This tree was situated about 100 yards from the sea and at least a quarter of a mile from the nearest fresh water, which consisted of a small well.

Subsequent investigations showed that numerous puparia could be found on or just below the surface of the ground around any of

the oil palms from which the lower petioles had not been removed, and which in consequence shaded an area of ground in the immediate neighbourhood of the trunk. It was a striking fact however that they were not to be found except in solitary instances in the soil held in the angles between the petioles and the trunks. Only occasional puparia were found at the bases of mangoes and cotton trees.

Although tsetse were found among the mangrove swamps at least half a mile from dry land no puparia were found in the sandy mud of the swamps either at high or at low tide. They were found however under the palms immediately above high water mark. Experiment showed that pupae deposited on sea water or covered with sea water for a number of hours each day do not hatch. The authors' conclusions are as follows :—

" 1. The breeding grounds of *Glossina palpalis* are not so strictly limited to the immediate vicinity of water as has hitherto been thought; they may occur quite independently of fresh water and at least a quarter of a mile from sea water.

" 2. Although *Glossina palpalis* is to be found in considerable numbers in mangrove swamps and may travel in these to a distance of at least half a mile from dry land, the swamps do not constitute a breeding ground of the fly.

" 3. The pupae of *Glossina palpalis* do not hatch when subjected to daily flotation on sea water.

" 4. The ground around the trunk of oil palms (*Eloëis guineensis*) which have not been stripped of their lower petioles constitutes an excellent breeding place for *Glossina palpalis*.

" 5. *Glossina palpalis* can breed in localities in which practically the only tree is the oil palm.

" 6. Stripping the oil palm of the lower petioles would suffice to destroy the breeding ground in such localities."

(177) BEQUAERT (J.). Note sur la dispersion des Glossines au Congo belge. [Note regarding the Dispersion of Glossinae in the Belgian Congo.]—*Bull. Soc. Path. Exot.* 1915. July. Vol. 8. No. 7. pp. 463-467.

This paper contains a record of the places in which the author has encountered *G. palpalis*. On two occasions he has seen Glossinae being attacked by a carnivorous spider and a dragon-fly respectively, and he thinks that these enemies of the tsetse flies are not altogether negligible.

Tsetse flies have never been found by the author at an altitude higher than 1,200-1,250 metres and he thinks that some error has been made with regard to the *G. palpalis* var. *fusciipes* said to have been found by CRONIER at from 1,500 to 3,000 metres.

It would appear that in inhabited regions the male and female flies are present in about equal numbers, with possibly a small balance in favour of the female, but in uninhabited areas there is a distinct predominance of the males.

In commenting on this paper ROUBAUD states that it would be unwise to affirm the absence of the flies from any particular area without taking into consideration their seasonal migrations, and he also points out that the apparent predominance of males in uninhabited areas may be due to the fact that food supplies are scarce in such places, and that the more active male is more in evidence than is otherwise the case.

- (178) NEAVE (S. A.). The Tabanidae of Southern Nyasaland with Notes on their Life-Histories.—*Bull. Entom. Research*. 1915. Mar. Vol. 5. No. 4. pp. 287-320. With 30 text-figs. & 5 plates.

The flies described in this paper were nearly all collected in the neighbourhood of Mt. Mlanje, close to which the author had his headquarters on the Luchenya River.

A brief description of the area covered is given and special attention is drawn to the rainfall in one part of it. On the southern and south-eastern slopes of the mountain the average fall is about 100 inches, while in other parts it is only 35 inches. This is accounted for by the fact that all the rain clouds come up from the south and south-east.

On the higher plateaus of the mountain the only representative of the genus *Tabanus* was *T. taeniola variatus*, Wlk. The genus *Haematopota* was largely represented by *H. distincta*, Ric., and by a few examples of other species. The only other Tabanid discovered in this district was the new species *Silvius monticola*, of which a description is given in the paper.

In the forested areas at a level of from 2,000 to 3,000 feet lower than the plateaus Tabanidae were more common, but members of the genus *Tabanus* were still not numerous. *Haematopota nobilis* was fairly common and the new species mentioned was largely represented. *C. magnifica* var. *inornata* was the only species of Chrysops found in this area.

In the heavily wooded areas at the foot of the mountain Tabanidae were not numerous, but a number of different species were represented. The most remarkable species obtained, *Silvius apiformis*, bears a singular resemblance to the honey-bee, and it is possible that a new genus will have to be formed for this species. In the drier country outside the range of the climatic influences of Mt. Mlanje, Tabanidae, and in particular members of the genus *Tabanus*, were especially numerous.

As the study of the breeding habits of the Tabanidae were the principal object of the author's expedition efforts were made to obtain larvae, at first with little success owing to the work having been begun at the wrong season, but afterwards with considerable success as regards numbers if not species. The first successes were obtained in the valley of the lower Shire and the Mwanza, and the experience obtained there rendered the discovery of larvae at the headquarters at Mlanje easier. From August to February considerable numbers of larvae of *Tabanus*, *Chrysops* and *Haematopota* were obtained, and from them adults were bred in most cases.

From the evidence obtained it would appear that the Tabanids of Nyasaland have only one brood a year, but it is possible that certain species of *Chrysops* and *Haematopota* may have two broods. Much however depends no doubt upon the food supply for the larvae, and climatic and other conditions.

In many cases the larva grows very slowly and may require six months before it is full-grown. The larvae then have a resting period during which they remain buried in mud or sand. In the author's experience the pupal stage is very short, ranging only from 10 to 18 days.

One of the difficulties encountered in connection with the question of the number of broods per annum lay in the fact that the larvae from

any batch of eggs may show a very variable rate of growth, which results in the emergence of the adults being spread over long periods. There appears to be a possibility that individuals which miss their normal period for pupation may remain in the larval stage until the following year.

Before larvae have reached their full development they usually lie buried in mud head downwards with their syphons projecting above the surface. In the subsequent resting stage the syphons do not appear to be used, for the larvae may remain several inches below the surface for periods extending into months. Pupation generally takes place in normal conditions about an inch below the surface of the mud, the pupa being upright in position. When pupation is complete and the case has hardened the pupa works its way up until the head is just below the surface. The pupa is generally yellowish or greenish in colour at first, but it darkens as the imago develops.

The imagines of all species almost invariably emerge between noon and 3 p.m. and the method of emergence is the same in all species.

Considerable difficulty was experienced in keeping various Tabanidae alive in captivity, but by adapting the cages in various ways a certain degree of success was obtained.

In a few cases captive flies oviposited, the process requiring about an hour. The cement material covering the egg masses appears to be very resistant, as immersion of the masses in 70 per cent. alcohol for two days did not absolutely prevent hatching in some instances.

In the cases observed hatching took place on the fifth day, but the interval varied with the temperature. The young larvae grow very slowly at first and differ from the more mature ones by being far more active.

Characters which appear to be of value in the differentiation of species are, the arrangement of the group of hooks at the termination of the last segment, and the nature of the uppermost section of the series of combs on the anterior part of the last segment of the pupae. For the former of these features the author suggests the term "aster."

The areas of pigmented hairs on the base of the last segment of the larvae appear to be of value as distinguishing characters, especially among the Haematopota.

The paper contains short accounts of the adult flies, pupae and larvae obtained, many of the descriptions being illustrated.

(179) BULLETIN OF ENTOMOLOGICAL RESEARCH. 1915. Mar. Vol. 5.
Pt. 4. pp. 381-382. Observations on *Glossina morsitans* in
Northern Rhodesia. [EMINSON, R. A. F.]

The report contains an account of the author's investigations into the bionomics of *G. morsitans* carried out in Northern Rhodesia from May to July, 1914.

While no definite reason could be ascertained for the marked preference given to certain restricted areas for breeding purposes, it was observed that breeding never occurred in areas where there was any depth of sandy soil, and where there was long grass. The places preferred were close to the paths among trees where there was only a very thin layer of sand on the granite, and where there was only a

little short grass. Game did not seem to be more numerous or even as numerous in the areas where the flies were found as elsewhere. It appeared that the females preferred logs which were devoid of bark and which were raised up from the ground for an inch or two at one end for the depositing of their larvae.

Experiments in connection with the feeding of flies exclusively upon avian blood failed owing to the unsuitable nature of the cages used.

During May 1914, 300 flies were examined as to the nature of their intestinal contents. Recognisable blood was found in 43 of them, and in all but two mammalian blood was found. Of the flies examined during February and March it is said that only 1 per cent. contained non-mammalian blood, but the actual numbers are not given. This may be explained partly by a seasonal variation of available food supply, and partly on the supposition that during May the greatest number of larvae are deposited and that the flies during that month would be more voracious.

Some interesting points are dealt with in connection with the parasites of *G. morsitans*. A wingless parasitic wasp of the genus *Mutilla* was obtained from one puparium in a batch of 258. The parasite made its escape exactly as would have the fly, and it was impossible to say from an external examination of the pupa that it was parasitised. Of 84 pupae which remained unhatched towards the end of August, seven were opened. Two contained the larvae of the parasite, and the other five pupae had died from other causes. Two males and eight females of the genus *Mutilla* hatched out from among the remaining 77 puparia.

A Chalcid has also been found attacking tsetse pupae on three occasions.

(180) LAMBORN (W. A.). A Preliminary Report on the Problem of controlling *Glossina* in Nyasaland.—*Bull. Entom. Research.* 1915. June. Vol. 6. No. 1. pp. 59-65.

The author's first object was to discover a small isolated area where experiments could be carried out both by clearing and by capture of the flies on a large scale to determine the effects of these measures upon the numbers of flies present. With this object he proceeded to the areas described by SHIRCORE [see this *Bulletin*, Vol. 2. No. 3. p. 147.]

A brief description of his examination of the areas is given and his observations are summarised as follows:—

"No evidence of the natural splitting of the northern portion of the fly area in the dry season into two *small* localised patches was found, though two large areas do certainly exist as a result of the subdivision of one larger one by native clearings; and in the southern portion, examined after a few scanty rains, the two so-called "primary centres" were certainly continuous with each other and with the northern portion of the area, the fly extending over so large a region as to make one sceptical in regard to the possibility of their limitation to within narrow patches so short a time before."

The undoubtedly concentration of the fly in this district in the dry season is coincident with the concentration of the game and is due to the nature of the soil; the conditions of moisture and, in consequence, of vegetation even during the dry season are a sufficient explanation of the concentration of the game and therefore of the fly.

In spite of this the author finds that the foci from which the fly radiate when the grass appears and the game spreads are far too large to permit of any useful results being obtained from efforts to clear the land or catch the flies on a large scale. He has, further, not been able to discover that the "primary centres" form localised breeding grounds.

Flight experiments with *G. morsitans*.—Working with some hundreds of flies the author released them after marking them at distances ranging up to ten miles from the place at which they were caught. He obtained evidence in ten instances of flights of five miles, and in one instance of a flight of ten miles. The country traversed by the flies was well wooded and devoid of open spaces. No flies were recaptured in directions away from the main fly area. None of the flies were fed before they were released.

Records of the numbers of flies captured and the proportions of the sexes have been kept, but as the number of boys working has not been constant and the work has not been uniform no exact deductions can be drawn from the figures given, which show that there were 2,040 males to 420 females.

Attempts to trap flies in a cage the interior of which was smeared with bird-lime and in which a goat was kept were not successful, apparently because the goat could not move about sufficiently to permit the flies to see it.

When bird-lime was smeared upon various materials carried on the backs of boys the number of flies caught in six hours ranged from 7 to 67. Light brown paper appeared to yield the best results.

Among the enemies of *G. morsitans* there has been observed a Bembex which has been seen to seize the flies and carry them away.

Negative results were obtained when flies were caged with caterpillars to see if they would feed upon them.

A new area of fly has been found in the Marimba district of Nyassaland just north of the Duangwa River, where it crosses into Rhodesia.

- (181) YORKE (W.) & BLACKLOCK (B.). Food of *Glossina palpalis* in the Cape Lighthouse Peninsula, Sierra Leone. (Being the Second Report of the Thirty-second Expedition of the Liverpool School of Tropical Medicine, 1914-1915).—*Ann. Trop Med. & Parasit.* 1915. July 31. Vol. 9. No. 3. pp. 363-379.

CONCLUSIONS:—

" 1. About eight per cent. of the wild *G. palpalis* in this district contain recognisable red blood cells—seven per cent. of mammalian origin and one per cent. nucleated red cells of unknown origin.

" 2. Seventy-two hours after *G. palpalis* had completely distended itself on rat's blood recognisable red cells could no longer be found in its intestine ; after being fed on a fowl nucleated red blood cells could be recognised in 40 per cent. of cases at the end of a similar period. The flies were kept at a temperature of 80°-86° F.

" 3. Neither shed blood nor other fluid which is exposed (not covered by a membrane) can be imbibed by *G. palpalis*.

" 4. *G. palpalis* can take up through a membrane of fresh skin not only blood and various dilutions of it with normal saline, but also suspensions of red blood cells in normal saline, and solutions of haemoglobin (both freshly made from red blood cells, and the dried crystalline preparation of commerce) in distilled water.

" 5. Fluids other than blood such as solutions of sugar, sodium chloride, and glycerine, in water containing a small quantity of a dye (methylene blue, neutral red or fuchsin) are also taken up through a membrane of fresh skin by *G. palpalis*, but not so quickly or so readily as is blood.

" 6. *G. palpalis* exhibits a definite selective taste for the various fluids presented to it under the membrane; blood, red cells, and haemoglobin solution being much preferred. The attractive element in the blood is the fraction of the red cells soluble in water, probably haemoglobin.

" 7. *G. palpalis* which had been starved for a day or two can often be seen to insert the proboscis repeatedly into oranges, bananas or other fruits which may be offered them.

" 8. We are of opinion that *G. palpalis* in nature may under certain conditions take up fluid other than blood."

- (182) WATERSTON (J.). Chalcidoidea bred from *Glossina morsitans* in Northern Rhodesia.—*Bull. Entom. Research.* 1915. June. Vol. 6. No. 1. pp. 69-82. With 5 text-figs.

This report is based upon specimens and notes supplied by LLOYD, and deals with three species of Chalcidoids which have been bred from puparia collected by LLOYD and EMINSON. Two of the specimens described and figured in the report are believed to be new. In a note by the editor it is shown that seven parasitic insects of *Glossina* are now known, and in a short table are given the names of the parasites, their hosts, the locality of their discovery, and the name of the investigator discovering them. Five of the parasites are Hymenoptera and two Diptera.

- (183) HIRST (S.). On a Widely distributed Gamasid Mite (*Leiognathus morsitans*, sp. n.), Parasitic on the Domestic Fowl.—*Bull. Entom. Research.* 1915. June. Vol. 6. No. 1. pp. 55-58. With 3 text-figs.

The parasite described by the author has a wide distribution in Africa, and also occurs in Mauritius, China, India, and South America, and it is suggested that it may play some part in the transmission of spirochaetes and other parasites of the fowl. It is not settled whether the parasite is identical with that described by BERLESE as *Leiognathus bursa*.

MISCELLANEOUS.

- (184) BOQUET (A.) & NÈGRE (L.). Sur l'évolution du parasite de la lymphangite épidotique chez le cheval. [The Development of the Parasite of Epizootic Lymphangitis in the Horse.]—*Bull. Soc. Path. Exot.* 1915. May. Vol. 8. No. 5. pp. 248-250.

The authors record that they have attempted to infect horses by subcutaneous, intradermic and intravenous inoculation with pure cultures of the seventh and ninth generations of the cryptococcus, but that so far they have failed to set up the disease with the characteristic lesions. They have however constantly obtained a result which requires further investigation and verification, but which they think it advisable to publish pending their being able to return to the study of the subject.

A horse which had never shown any evidence of being infected was inoculated with a pure culture by both the intradermic and the subcutaneous methods at different parts of the body, and as no evidence of infection had appeared after an interval of two months it was given an intravenous inoculation with 1 cc. of a similar culture. Three weeks later an area of oedema appeared on the fore-arm about 15 centimetres below one of the points where intradermic inoculation had been practised. This persisted for about a week and the spot was subsequently marked by a slight loss of hair and an elevation of the epidermis.

Microscopic examination of the epidermis showed the following structures in small numbers. There were typical double-contoured cryptococci, rather large rounded forms, some of which showed evidence of budding collected together into masses of 10 to 15, and short thick-walled filaments which were swollen at one end exactly like the chlamydospores observed in the cultures. The lesion subsequently healed. No structures of the same type could be found in materials scraped from other parts of the skin.

(185) HEDINGER. *Pathological Investigation into Lamziekte*.—*Report to the Minister of Agriculture. 1914. Dec. 1915. Pretoria: Published by the Government Printing and Stationery Office.*

After dealing at some length with the previously published records regarding the disease the author passes to a short description of each of 52 cases examined. Summarising the lesions found in these he finds that special importance attaches to the presence of degenerative lesions and inflammatory changes in the muscle and nerves respectively.

The author then deals with the theories that have been put forward at different times to explain the symptoms and lesions of the disease. He finds that these—the infection, the poisonous plant, the want of nutrition, and the accumulative vegetable poison theories—are all unsatisfactory.

The general opinion arrived at is that the disease is in some way connected with the presence of sarcosporidia in the muscles, although these parasites may be found in the muscular tissues of animals that are not affected.

The last paragraph but one in the author's report is as follows:—

"Lamziekte is a disease which is very well characterised by histological changes of the cross-striated muscles, and in most cases of the nervous system, and by the presence of sarcosporidia. Although, owing to the incomplete knowledge of the sarcosporidia it is still not possible to prove experimentally the importance of the sarcosporidiosis for the lamziekte, it is quite possible, taking into consideration the facts that are known about sarcosporidia, that these protozoa are the cause of lamziekte. The sarcosporidiosis explains without difficulty the whole nature of lamziekte. Be it that the sarcosporidia are or are not responsible for lamziekte, in all further investigations the question of the importance of sarcosporidia must have the first place."

(186) BEVAN (Lt. E. W.). *Contagious Abortion in Rhodesia*.—*Jl. Comp. Path. & Therapeutics. 1915. June. Vol. 28. No. 2. pp. 97-104.*

In this paper the author records the occurrence of contagious abortion in cattle in Rhodesia, and shows that the organism responsible for the disease is identical with that causing it in Europe and other parts of Africa.

Details of a few experiments regarding the production of agglutinin with living and dead bacilli are given, by which it is shown that the injection of dead bacilli will cause the production of agglutinin in proportion to the dose of bacilli given. But, as stated by the author, no conclusions can be drawn as to the respective value of the methods for producing immunity.

REPORTS.

(187) GRAY (C. E.). Annual Report of the Union of South Africa, 1913-1914. Veterinary Division. 1914. Aug. 10. 24 pp.

East Coast Fever.—General progress has been made in dealing with this disease, but in certain areas difficulties are experienced. These are due in part to insufficient numbers on the veterinary staff, unwillingness of some owners to take sufficient care of their stock, and the difficulties encountered in dealing with native owners.

Tuberculosis.—Lack of funds prevents this disease being taken in hand in a manner likely to lead to its proper control, and it is pointed out that unless steps are taken soon the hold gained by the disease may become too great to allow it to be dealt with radically. The percentage of reacting animals has risen from 2·35 to 4·87 since last year. Of imported animals 3·8 per cent. reacted to the tuberculin test and were destroyed.

Anthrax is becoming more and more serious and in places is likely to become such a scourge that general protective inoculation will have to be practised.

Glanders, lungsickness, equine marge, epizootic lymphangitis, swine fever, and contagious abortion appear to be held well in hand.

BOOK REVIEW.

- (188) BANHAM (George A.) [F.R.C.V.S.] & YOUNG (Wm. J.) [F.R.C.V.S., D.V.S.M. (Vict.).] *Table of Veterinary Posology (In Accordance with the British Pharmacopoeia, 1914) and Therapeutics with Weights, Measures, etc., for the Use of Students and Practitioners.* —4th Edit. xvi + 272 pp. f'cap. 8vo. 1915. London: Baillière, Tindall & Cox. [Price 3s. 6d. net.]

Seven years have elapsed since the third edition of this book was published. The edition which has just come to hand has been necessitated by the appearance of the new British Pharmacopoeia issued last December.

The book should prove of even more value than hitherto as it contains much new material. In fact every branch of the veterinary art seems to have been dealt with, and the general plan is such that it should enable anyone to obtain information regarding a doubtful point quite readily.

The great bulk of the contents of the volume is given in tabular form, and strangely enough the least satisfactory section is that from which the volume gets its title, namely, the table enumerating the pharmacopoeial drugs, their preparations, and their doses. Many of the drugs mentioned are not official in the British Pharmacopoeia, and consequently they cannot be accurately described as "pharmacopoeial drugs." A few more cross-references would add to the value of this table. For instance, we are not reminded that barbitone is the pharmacopoeial name for veronal, nor that benzamine lactate is β -eucaine.

In one or two instances there have crept in inconsistencies in the doses. The dose of acetosalicylic acid for the dog is given as 5–15 grains; under aspirin the dose is 2–10 grains. Again, the dose of barbitone is given as 2–10 grains, of veronal 10–60 grains.

The passage of the third-year student through his classes would be rendered less arduous were there an official list of drugs used in veterinary medicine with a table of standardised doses. The suggestion forces itself upon one that the authors should attempt something of the kind in their next edition. The tinctures might first be taken in hand. In the British Pharmacopoeia the tinctures are divided into two main divisions, those of which the dose is 5–15 minims, and those of which the dose is $\frac{1}{2}$ –1 fluid drachm. In the table referred to matters are very different. Thirteen tinctures picked at random show nine different doses, whereas they could readily be put into two groups as in the B.P.

The next section deals with official and other formulae. In some cases the strengths of the preparations given in this table do not agree with those given in the one mentioned above. This is particularly noticeable in the case of the preparations of iodine. The question of solubilities appears hardly to justify the expenditure of 24 pages upon it.

The diseases of the domesticated animals are dealt with in sections upon protozoa, bacteria, parasites, etc.

Food-stuffs and feeding receive due consideration and the information given should be of value to the practitioner who is required to suggest alternative diets.

The table of anatomical weights, capacities, and measurements contains many useful data not usually so conveniently collected together. A further very useful table is that showing the special terms that are applied to animals at various ages.

Altogether the book is crammed with information of all kinds, not even excluding postal information.

The volume might be called the veterinary surgeon's *vade mecum*, and it should take first place as a book of reference in very small compass.

B. Gorton.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 3, No. 2, pp. 78-79.]

Leishmaniasis.

- (189) LAVERAN (A.). Leishmaniose américaine de la peau et des muqueuses. [American Leishmaniasis of the Skin and of the Mucous Membranes.]—*Bull. Soc. Path. Exot.*, 1915. May. Vol. 8. No. 5, pp. 284-301; No. 6, pp. 382-397.
- (190) SERGENT (Ed.), SERGENT (Et.), LEMAIRE (G.), & SENEVET (G.). Hypothèse sur le phlébotome "transmetteur" et la tarante "réservoir de virus" du bouton d'Orient. [The Hypothetic Phlebotomus Transmitter and Lizard Reservoir of Oriental Sore.]—*Ann. Inst. Pasteur*, 1915. July. Vol. 29. No. 7, pp. 309-322.
- (191) SPAGNOLIO (G.). Leishmaniosi canina ed umana e loro presunta dipendenza genetica. [The Supposed Relationship between Canine and Human Leishmaniasis.]—*Malaria e Malat. d. Paesi Caldi*, 1915. May-June. Vol. 6. No. 3, pp. 156-157.

Spirochaetosis.

- (192) FANTHAM (H. B.). *Spirochaeta bronchialis*, Castellani, 1907, together with Remarks on the Spirochaetes of the Human Mouth.—*Ann. Trop. Med. & Parasit.*, 1915. July 31. Vol. 9. No. 3, pp. 391-412. With one plate comprising 68 figs.

Trypanosomiasis.

- (193) AUBERT (P.). Sur deux cas de Trypanosomiase observée chez des Européens au Congo Français. [Two Cases of Trypanosomiasis observed in Europeans in the French Congo.]—*Bull. Soc. Path. Exot.*, 1915. June. Vol. 8. No. 6. pp. 372-377.

Biting Flies and Ticks.

- (194) BEQUAERT (J.). Sur quelques Auchmériomyies du Congo. [Some Auchmeromyias of the Congo.]—*Bull. Soc. Path. Exot.*, 1915. July. Vol. 8. No. 7, pp. 459-462. With 1 text-fig.
- (195) BOUET (G.) & ROUBAUD (E.). Nouvelle observation sur les Chéromyies de l'Afrique Occidentale. [New Observation regarding the Cheromyias of West Africa.]—*Bull. Soc. Path. Exot.*, 1915. Vol. 8. No. 7, pp. 462-463.
- (196) EDWARDS (F. W.). New and Little-Known East African Culicidae.—*Bull. Entomol. Research*, 1915. Mar. Vol. 5. No. 4, pp. 273-281. With 3 text-figs.
- (197) EDWARDS (F. W.). Diagnoses of New Bornean Culicidae.—*Bull. Entomol. Research*, 1915. Mar. Vol. 5. No. 4, pp. 283-285.
- (198) HARRISON (L.). Mallophaga from Apteryx, and their significance; with a Note on the Genus Rallicola.—*Parasitology*, 1915. June. Vol. 8. No. 1, pp. 88-100. With 6 text-figs.
- (199) HARRISON (L.). The Respiratory System of Mallophaga.—*Parasitology*, 1915. June. Vol. 8. No. 1, pp. 101-127. With 21 text-figs.
- (200) MACFARLANE (H.). The Stegomyia Survey in Hong Kong.—Abstract of Interim Report to Colonial Office in the *Bull. Entomol. Research*, 1915. June. Vol. 6. No. 1, pp. 67-68.
- (201) ROBINSON (L. E.). A Note on the Variability in size of *Amblyomma hebraicum* Koch.—*Parasitology*, 1915. June. Vol. 8. No. 1, pp. 11-16. With 3 text-figs.

- (202) RODHAIN (J.). Note sur la ponte des Oestrides des genres Gyrostigma et Cobboldia. [Note on the Oviposition of the Oestridae of the Genera Gyrostigma and Cobboldia.]—*Bull. Soc. Path. Exot.*, 1915. May. Vol. 8. No. 5, pp. 275-279. With 1 fig.
- (203) RODHAIN (J.) & BEQUAERT (J.). Sur quelques Oestrides du Congo. (Communication préliminaire.) [Certain Oestridae of the Congo. Preliminary Communication.]—*Bull. Soc. Path. Exot.*, 1915. July. Vol. 8. No. 7, pp. 452-458.
- (204) STANTON (A. T.). A New Anopheline Mosquito from Sumatra.—*Bull. Entomol. Research*, 1915. March. Vol. 5. No. 4, pp. 373-375. With 2 text-figs.
- (205) STRICKLAND (C.). The Comparative Morphology of the Anophelines *Nyssomyzomyia ludlowi*, Theo., and *N. rossi*, Giles.—*Bull. Entomol. Research*, 1915. Mar. Vol. 5. No. 4, pp. 321-324. With 2 text figs. & 2 plates.
- (206) TURNER (R. E.). A New Species of *Mutilla* Parasitic on *Glossina morsitans*.—*Bull. Entomol. Research*, 1915. Mar. Vol. 5. No. 4, p. 383. With 1 text-fig.

Helminths.

- (207) BARKER (F. D.). Parasites of the American Muskrat (*Fiber zibethicus*).—*Jl. of Parasit.*, 1915. June. Vol. 1. No. 4, pp. 184-197. With 2 plates & 4 text-figs.
- (208) FRANCHI (A. F.). Contributo allo Studio della dermosifiliosi bovina. (Bovine dermosifilariasis.)—*Il. Mod. Zootro.* Parte Scientifica. 1915. June. Vol. 26. No. 6, pp. 260-267. With 4 text-figs.
- (209) NICOLL (W.). The Trematode Parasites of North Queensland. III. Parasites of Fishes.—*Parasitology*, 1915. June. Vol. 8. No. 1, pp. 22-40. With 2 plates comprising 11 figs.
- (210) RAILLIET (A.) & HENRY (A.). Sur les Nématodes du genre *Goezia* Zeder. [The Nematodes of the Genus *Goezia* Zeder.]—*Bull. Soc. Path. Exot.*, 1915. May. Vol. 8. No. 5, pp. 270-275.
- (211) SEURAT (L.-G.). Sur les Rictulaires des Carnivores du Nord-Africain et les affinités du genre Rictularia. [The Rictulariae of the North African Carnivora and the Relationships of the Genus Rictularia.]—*C. R. Soc. Biol.*, 1915. June 25. Vol. 78. No. 11, pp. 318-322. With 3 text-figs.
- (212) TIRUMURTI (T. S.). A Case of Perforation of the Aorta by *Spiroptera sanguinolenta* in a Hound.—*Vet. Jl.*, 1915. Aug. Vol. 71. No. 482, pp. 384-387. With 2 text-figs.

Miscellaneous.

- (213) CHATELAIN (M.). Sur le traitement de la Lymphangite Epizootique. [The Treatment of Epizootic Lymphangitis.]—*Rev. Gén. Méd. Vét.*, 1915. July 1. Vol. 24. No. 284-285, pp. 387-392.
- (214) van SACEGHEM (R.). Dermatose contagieuse (Impétigo contagieux). [Contagious Dermatitis.]—*Bull. Soc. Path. Exot.*, 1915. June. Vol. 8. No. 6, pp. 354-359.
- (215) van SACEGHEM (R.). Etude sur une épizootie parmi les goretts de la station d'élevage de Zambi. [An Epizootic among the Young Pigs at the Breeding Station at Zambi.]—*Bull. Soc. Path. Exot.*, 1915. June. Vol. 8. No. 6, pp. 360-362.
- (216) van SACEGHEM (R.). Observations sur la Dermite granuleuse. [Granular Dermatitis.]—*Bull. Soc. Path. Exot.*, 1915. June. Vol. 8. No. 6, pp. 362-363.

TROPICAL DISEASES BUREAU.

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TRYPANOSOMIASIS.

- (217) Reports of the Sleeping Sickness Commission of the Royal Society.—No. XVI. viii + 221 pp. with plates & maps. 1915. London : Printed under the authority of His Majesty's Stationery Office. [Price 8s.]

The majority of the papers included in this report have already been published elsewhere, and abstracts of these have appeared in this *Bulletin*.

The introduction contains the names of the members of the Commission, and a brief description of the headquarters at Kasu. There is also included a summary of the work done and a review of the practical recommendations that arise out of it. These are : That every effort should be made to diminish the number of wild animals in the fly-areas ; That infected natives should be moved into fly-free areas ; That the land around villages should be cleared ; That prophylaxis and drug treatment are at present of little value ; and That the fly cannot be attacked directly.

As a result of the examination of small mammals living in the Proclaimed Area the conclusion is arrived at that these do not constitute a source of danger to man. Domestic animals in the same area may act to some extent as reservoirs of the disease, but their numbers are so small in the fly-areas that little danger is to be anticipated from their presence there.

The species of flies found in Nyasaland are *Glossina morsitans*, *pallidipes*, and *brevipalpis*. *G. palpalis* has not been found.

Dissection of 496 specimens of wild *G. brevipalpis* shewed that 44 contained trypanosomes. Of nineteen of these it was thought that *T. brucei vel rhodesiense* was found once, *T. pecorum* nine times, *T. simiae* once, and *T. grayi* eight times. In ten cases the flagellates were thought to belong to a pathogenic species, but to which was not known. No opinion could be expressed in the remaining fifteen cases.

A few experiments were made to test the infectivity of *G. brevipalpis*, and a monkey, a goat, and a dog were infected with *T. pecorum* by that insect.

In Section E of the Report the authors deal with investigations carried out with three strains of *T. gambiense* obtained from Lake Tanganyika. From an examination of the morphology of these parasites the authors conclude that *T. gambiense*, Tanganyika, is very

similar to *T. brucei* vel *rhomasiense*, and that though it would appear to be possible to distinguish them in the blood of rats, owing to the common occurrence there of blunt-ended posterior nuclear forms of the latter species, they cannot be distinguished microscopically in the blood of man.

With regard to the pathogenicity of the two parasites, *T. gambiense* does not so rapidly infect experimental animals as *T. brucei* vel *rhomasiense*, and when the trypanosome has become accustomed to a particular species the disease produced is far more chronic.

In a number of experiments the development of *T. gambiense* in *G. morsitans* was investigated. This parasite did not appear to develop so rapidly as *T. brucei* vel *rhomasiense*, and in positive experiments the period elapsing between the infecting meal and the fly becoming infective was at least 50 days.

In an appendix is given a tabular statement regarding the pupation of *G. morsitans*. From this it may be gathered that the duration of pupation ranged from 30 days in October to 68 days in June.

(218) WATSON (E. A.). Dourine and the Complement Fixation Test.—
Parasitology. 1915. Sept., Vol. 8. No. 2. pp. 156-183.

After a very extensive experience of the method the author has arrived at the conclusion that the complement fixation test is a sure and specific method of diagnosing dourine. The value of the test has been proved not only in cases shewing symptoms of the disease, but also in obscure and latent forms of infection.

The importance of this last point is plain when it is known that infected animals may remain in apparent good health for as long as three years, while capable of transmitting the infection at times during that period.

A brief explanation of the general nature of the reaction is given, and especial emphasis is laid upon the absolute necessity of carrying out quantitative titrations of the various elements used in the test.

Preparation of the reagents.—

Sheep corpuscles are used for the hyperimmunisation of rabbits. The corpuscles from defibrinated blood are washed three times and then mixed with a volume of salt solution equal to their own volume. This 50 per cent. suspension may be stored on ice until required.

Rabbits are hyperimmunised by intraperitoneal injections of the suspension mentioned, starting with 2·5 cc. and increasing to 10 cc., at intervals of 4 to 5 days. Blood may be withdrawn from the heart with a fine needle on a syringe during life. After inactivation it is tested and the haemolytic index should be 0·0005 or higher. From rabbits whose serum gives this index as much as 25 cc. of blood may be drawn from the heart without risk. This is allowed to clot and the serum placed in ampoules in amounts of about 0·2 cc., which are stored on ice. If there is a chance that the serum is not perfectly sterile one-tenth of its volume of a mixture of 95 volumes of glycerin and 5 of phenol may be added.

For obtaining complement it is advised that a guinea-pig should be anaesthetised and suspended over a centrifuge tube of about 30 cc. capacity, the arteries and veins on one side of the neck being severed and the blood collected. The blood is centrifuged before coagulation takes place. Complement must be used fresh.

The antigen is obtained from the blood of infected rats when it is swarming with trypanosomes. A number of rats are inoculated intraperitoneally with blood, and death generally takes place between the third and the fifth day. The obtaining of blood from the rats must be carefully timed, as during the last hours of life the trypanosomes multiply at a great rate and rich antigen is obtainable, but within a few hours the rats may die.

The rats are etherised and the vessels on the left side of the neck are severed with a razor. It is preferable not to sever the trachea. The blood is allowed to run into citrate solution, the volume of which should be equal to or slightly larger than the amount of blood that it is expected will be obtained from the rats. This mixture is filtered through a double layer of sterile gauze and run into centrifuge tubes of 10 cc. capacity and about 10 mm. diametre. Centrifuge for four or five minutes at 1,500 to throw down the corpuscles. Draw off the suspension of trypanosomes and the upper layer of mixed cells and trypanosomes and by the addition of further citrate solution and centrifuging a pure white suspension of trypanosomes may be obtained.

It is stated that ten rats bled at the same time will furnish 5 cc. of trypanosome suspension. This is diluted with twice its volume of preserving fluid containing 90 cc. of salt solution, 10 cc. of glycerin, and 0·1 cc. of formalin. It is then sealed in ampoules containing 1 cc. and stored in ice.

The amount mentioned will provide 100 cc. of antigen which is sufficient for 500 tests. The stock antigen will keep indefinitely if frozen solid, and for 6 to 8 weeks if merely on ice.

To obtain control sera containing antibody a horse is inoculated with *T. equiperdum* and blood is collected at intervals of a week. Serum so obtained may be kept on ice for months or even years. If the serum is not sterile it may be preserved by the addition of 10 per cent. of 5 per cent. carbolised glycerin or iodised glycerin.

In titrating the reagents the following stock mixtures are used :—

Haemolytic serum 1 : 100.

Complement 1 : 20.

Corpuscle suspension 1 : 25.

In titrating the haemolytic serum further dilutions from 1 : 400 to 1 : 5,000 are made, and in a series of tubes 1 cc. of each of these is taken and to each tube are added 1 cc. each of stock complement and corpuscle suspension and 2 cc. of salt solution. This makes the total amount in each tube 5 cc. Controls omitting each element in turn are also used. The tubes are incubated for 2 hours at 37° C.

In this way the least quantity of serum necessary to haemolyse a given quantity of corpuscles, i.e., the titre of the serum, is obtained, and is conveniently expressed by the figure indicating the actual amount of serum present in 1 cc. of the completely effective dilution.

Sera with a value lying between 0·0002 and 0·0005 are satisfactory.

By making a series of tests in which the number of amboceptor units is increased while the amount of complement is diminished it is possible to arrive at a decision as to the number of amboceptor units which work most satisfactorily with the smallest amount of complement. It renders the test the more delicate if the smallest safe amount of complement is used. The reduction in the amount of complement must not be pushed too far as slightly inhibitive properties

of some of the other reagents may obscure the result. Having fixed in this way the number of amboceptor units to be taken as the standard, this is adhered to, and the complement is titrated to that amount. It would appear that two units of amboceptor is the best standard.

In the titration of the complement a series of tubes containing 2 cc. of salt solution, increasing amounts of 1 : 20 complement from 0·3 to 1·0 cc., and 1 cc. of serum is diluted in such a way that the 1 cc. contains 2 units of amboceptor. The tubes are incubated after shaking and the reactions read in an hour. In this way the minimum effective amount of complement is arrived at, and from this it can easily be calculated what dilution of complement must be made so that this minimum amount is present in 1 cc. of dilution.

In titrating the antigen a 5 per cent. dilution of the stock suspension of trypanosomes is made, and also dilutions of haemolytic serum and complement according to the values arrived at.

Sera from a positive and from a negative horse are inactivated for 2 hours at 58° C.

Two sets of tubes are prepared, in the first of which each tube contains 1 cc. of salt solution, 0·1 cc. of positive inactivated serum, antigen in quantities ranging from 0·02 to 0·1 cc. and 0·5 cc. of complement. In the series of tubes for the negative serum double the amount of serum and of antigen is used.

The mixtures are shaken and incubated at 38°-39° C. for one hour and ten minutes, and then each tube has added to it 1 cc. of a mixture in equal parts of haemolytic serum and corpuscle suspension. The tubes are again shaken and incubated for 2 hours. The usual controls are also included.

With the exception of the first tube or two in the positive series all the tubes generally show complete fixation. When the antigen is very strong there may be some inhibition in the negative series in the tubes containing the larger amounts of antigen.

"The amount of antigen to be selected as the titre for the final tests is that which gives complete fixation with the positive serum while double the quantity in the corresponding tube in the negative series does not prevent or inhibit haemolysis."

While complement in horse's blood rapidly becomes inert even if the serum is not heated, horse, mule, and donkey sera when a day or two old develop enzymotic and proteolytic properties which are anticomplementary, especially in the presence of antigen.

This effect can be eliminated by careful inactivation, but the degree of heating is greater than that required for the destruction of complement. It is advised, therefore, that horse sera should be heated to 59° C. for a full hour in a water bath, and mule and donkey sera at 62° C. for the same length of time. There is little risk of destroying the specific antibodies, as sera can be heated to 65° C., or to the point of coagulation without destroying the specific antibody. All the non-specific factors are eliminated by the degree of heating mentioned.

It is noted that in non-specific inhibition of reactions the red corpuscles are loosely sedimented. In specific complement fixation reactions the red cells are precipitated in a mass or clumps.

Experience has shown that it is never necessary to use more than 0·2 cc. of a suspected serum for a diagnostic test. As even in weak sera such quantity will contain one unit of antibody, while strong

sera may contain 40 units. In animals that have completely recovered and are unable to transmit the disease such a quantity of serum may contain one or more units up to the fifth year after recovery. After that period they may not react, showing not only that recovery is complete but that immunity is also lost. This has been proved by inoculation experiments.

The period elapsing between infection and the first positive result to a complement fixation test may be as short as 11 days in the case of very virulent strains, but in practice a negative result should not be considered as conclusive when the interval between exposure to infection and the test is less than two months.

Details are given of the procedure adopted when only one or a small number of sera are to be tested, and the modifications of this plan that are introduced when large numbers are to be tested daily.

In the former case each serum has four tubes with varying amounts of suspected serum. In the latter case each serum is tested twice: On the first day only one tube is used for each and thus the negative sera can be excluded. These are retested with a single tube on the following day and the positive ones are tested each with four tubes. In all cases the reagents are titrated beforehand, and known positive and negative sera are tested.

In exceptional cases complement fixation is complete with 0·2 cc. of serum, partial with 0·15 cc. and slight with 0·1. This is a positive result and indicates that the serum is weak in antibodies. Generally speaking the results are either clearly positive or clearly negative.

- (219) WATSON (E. A.). *The Serum Test for Dourine.—Report of the Veterinary Director General, Canada, for the Year ending March 31, 1914.* Appendix No. 19. pp. 111–115.

In November 1913 the most extensive and destructive outbreak of the disease that has so far occurred was discovered in Alberta and Saskatchewan. Up to March 31, 1914, 3,200 complement-fixation tests, 730 agglutination tests, and 85 precipitin tests had been carried out. The number of sera giving positive reactions was 512.

It has been found that positive results can be obtained by serum tests long before any clinical symptoms have made their appearance and in view of the fact that the period of incubation is sometimes very prolonged this is of the greatest value. It appears to be inadvisable to consider any negative reaction as final until three months have elapsed since the last possible date of infection. Among the sera tested a few gave weak or doubtful reactions, but in several cases strong reactions were obtained when the test was repeated after an interval of two months.

It has been found that normal horse serum when fresh and unheated, or after storage for any length of time, is frequently strongly anticomplementary. And it has also been found that heating such serum for half an hour at 58°–59° C. is sufficient to destroy this power while not affecting antibodies in dourine sera. A temperature below 58° C. is not sufficient to destroy the anticomplementary power of the serum and may thus lead to incorrect results. Dourine sera that are weak in antibodies may lose their combining powers if heated to 60° C., although strong sera will withstand heating to 62° C.

When tests are to be made there should be heated along with the suspected sera two sera from normal horses, one of which is anti-complementary, and two sera from animals known to be infected with dourine, one of which is strong in antibody and the other weak.

Antigen is best prepared from the spleen of rats that have succumbed to infection in four days. Strains which require longer periods to prove fatal do not yield such good antigen.

The spleen should be not more than 24 hours old and should be kept on ice until required. The spleen is pulped up in 0·85 per cent. salt solution, and the coarser particles filtered out. One spleen will furnish from 30 to 50 cc. of antigen which generally titres out at 0·15 to 0·30 cc. in the presence of dourine antibody. Two or three spleens should be titred separately at the same time against positive and negative sera, and the emulsion selected should be that which effects complete combination in the smallest dose selected for the test.

The haemolytic system consists of :

Complement : Fresh guinea-pig serum.

Amboceptor : Anti-sheep rabbit serum, titring at 1 : 3,000 or higher.

Four per cent. suspension of sheep's blood corpuscles.

When a large number of sera are tested a double series of tests is carried out on consecutive days. In the first test only one tube is used for each serum and this contains a full dose or slight excess of serum. In this way all negative sera can be eliminated, and thus a saving in material effected. Those giving positive or partial results are retested on the following day with freshly inactivated serum, and where necessary a series of tubes with graduated amounts of serum is used. If questionable results are still obtained with any serum the agglutination test is applied or a fresh sample of serum is obtained for the test after an interval.

(220) HAWKE (W. L.). An Outbreak of Dourine.—*Report of the Veterinary Director General, Canada, for the Year ending March 31, 1914.*
Appendix No. 20. pp. 117-118.

In this paper some details are given of an extensive outbreak of dourine which occurred in Saskatchewan.

The mares of a group which had been served by a particular stallion in 1910 were observed to show symptoms during 1911, and subsequently a number of other mares which had been served by the same horse also developed symptoms. It is remarked that special interest attaches to this stallion as it was a pure-bred animal, and as a rule pure-bred horses show less resistance to the disease than others. This animal, however, did not at the time when the mares developed symptoms suspicious of dourine exhibit any evidence of being infected. At a later date, in 1912, severe symptoms developed and the animal was killed. This confirmed the diagnosis, which had been made on the evidence furnished by serological tests and, owing to the absence of symptoms, had been the cause of considerable controversy.

Subsequently a further batch of mares showed evidence of the disease and 67 contact animals were subjected to a test.

Strong evidence was obtained that animals which are apparently in perfect health may be infected and serve as centres of infection.

In no case where the serum test gave a negative result were symptoms ever observed, and animals which were apparently healthy but which gave positive results to the test sooner or later developed symptoms of infection.

The train of symptoms during what is called the "tolerant" stage of the disease was very mild. During the terminal stages there were very marked symptoms, especially of a nervous type.

The latter particularly affected the ears, lips, throat, and larynx. Involvement of the latter caused difficulty in breathing and was responsible for a kind of roaring. Paralysis of the hind quarters was noted but it was not marked. It is interesting to note that no plaques were ever observed.

(221) COLES (A. C.). Multiplication-forms of *Trypanosoma lewisi* in the Body of the Rat.—*Parasitology*. 1915. Sept. Vol. 8. No. 2. pp. 184–189. With 2 plates comprising 34 figs.

In this paper the author describes a number of forms that have been seen by him on different occasions spread over a period of years. The material for examination has been dead rats, and many of these have not been examined until some hours after death.

In a small proportion of cases coiled or recurved trypanosomes have been found in smears made from the lungs. They have been found in small numbers only, and always in association with the ordinary form of blood parasite. In some of the ball-like parasites no definite flagellum could be made out, though it was probably present. In a few cases oval bodies with a dense capsule and contents that appeared to suggest coiled up trypanosomes were seen in smears made from the lungs. In another case a small group of small oval bodies somewhat resembling Leishmania was found in a lung smear. The author has also found the lung cysts which were stated by CARINI to represent forms of *T. lewisi* undergoing schizogony, and figures of these are given for comparison with the small group of rounded bodies referred to.

In the heart blood and in lung smears respectively from two rats the author has found three large rounded structures measuring about 15 microns in diameter, composed of more or less vacuolated cytoplasm embedded in which were a number of chromatin masses. Each of the larger masses had associated with it a smaller piece, either round or rod-shaped. These forms were met with in the cases in which the coiled parasites were found. Photographs of these forms were submitted to MINCHIN who expressed the view that they certainly represented a stage of development of *T. lewisi*.

As numerous examinations of rats failed to reveal multiplication stages the author turned his attention especially to young naturally infected animals, and in one of these found many phases of multiplication of the parasite: parasites undergoing equal and unequal binary fission, irregular forms with three and even four nuclei, centrosomes, and flagella, and crithidial forms. All of these were found in the blood. No coiled forms or multiplication cysts were found in smears from the lungs of these animals.

In a later note the author states that in three further young rats he has found the parasite in all stages of division in the blood stream. In two of these coiled forms were found in the lungs in small numbers,

and in one specimens were found in preparations from the liver. In fresh preparations the coiled parasites appeared to be enclosed in clear cysts within which they executed twisting movements. The parasites were not observed to escape.

- (222) MAGGIO (C.) & ROSENBUSCH (F.). *Studien über die Chagas-krankheit in Argentinien und die Trypanosomen der "Vinchucas" (Wanzen, *Triatoma infestans*, Klug).* [Chagas' Disease in the Argentine and the Trypanosome of the Vinchuca.]—*Centralbl. f. Bakter. I. Abt. Orig.* 1915. Sept. 8. Vol. 77. No. 1. pp. 40-46. With 2 plates comprising 24 figs.

The authors do not appear to have actually detected any case of Chagas' disease in the Argentine, but in the intestinal canal of the common bug (*Triatoma infestans* Klug) they have found large numbers of flagellates similar to those described by CHAGAS.

In moist preparations two forms could be distinguished, a rapidly moving type which was trypanosome-like in form, and a more slowly moving type which was crithidial in morphology. In stained preparations intermediate forms could be detected. The former is said to resemble the trypanosome stage of *Leucocytozoon ziemanni* described by SCHAUDINN.

In freshly caught bugs the crithidial form appeared to predominate, and in bugs kept in the laboratory the trypanosomes tended to disappear.

The bugs in the northern and western parts of the Republic contained numerous flagellates, but those obtained from other parts appeared to be free from them.

Flagellates could not be found in bugs raised in the laboratory. It was found that clean bugs could acquire the infection from infected bugs either by the ingestion of excrement or, as was observed on a number of occasions, by one bug sucking the intestinal contents from another.

Experiments in which infected bugs were fed upon animals, and in which animals were fed with the excrement of infected bugs failed to give positive results. Nor did clean bugs become infected by feeding upon animals upon which infected bugs had previously been fed.

The subcutaneous or intraperitoneal inoculation of mice, rats, and guinea-pigs with the faeces of infected bugs caused infection, the trypanosomes making their appearance in the blood from the 3rd to the 18th day after inoculation. In mice death occurred in from 2 to 4 months. The infection could be transmitted from mouse to mouse, but not to other susceptible animals.

In infected animals cysts like those described by CHAGAS were found. Two types could be distinguished. One type contained parasites closely resembling Leishmania, and the other trypanosomes. Certain appearances were observed in preparations which suggested that the trypanosomes escaped from the cysts into the circulation.

In smears from the bone marrow parasites with the characters of Leptomonas were found. In blood-broth and on blood-agar positive cultures were obtained from the peripheral blood, heart muscle, striped muscle, and spleen. The parasites of which the colonies were composed were at first leishmania-like, but subsequently they developed flagella and acquired a crithidial form.

- (223) LAVERAN (A.). Au sujet des Trypanosomiases équines du Maroc. [Equine Trypanosomiases in Morocco.]—*Bull. Soc. Path. Exot.* 1915. Oct. Vol. 8. No. 8. pp. 576-578.

The author refers to the numerous communications that have been published regarding the occurrence of trypanosomiasis in horses in Morocco, and states that he has received from VIREY some blood smears taken from three horses at Mazis, on the road from Rabat to Fez. In these smears trypanosomes of the *soudanense* type have been found. All the individuals seen possessed a free portion to the flagellum. Those measured ranges from 23 to 30 microns in length and from 1 to 1.5 in breadth.

So far, all that can be said regarding equine trypanosomiases in Morocco is that there appear to be two types of trypanosomes responsible for the disease: the one obtained from Casablanca which is monomorphic, and that from Mazagan which is polymorphic.

The author advises that cross-immunity tests should be carried out with the object of establishing the identity of these parasites.

- (224) NUTTALL (G. H. F.) & HINDLE (E.). Experiments in the "Tryposafrol" Treatment of Trypanosomiasis (*T. brucei*) in Guinea-pigs and of Piroplasmosis in Dogs.—*Parasitology*. 1915. Sept. Vol. 8. No. 2. pp. 218-228.

The authors' conclusions may be summarised as follows:—

All the guinea-pigs infected with the trypanosome died whether they were treated or not, and as the treated ones with one or two exceptions died in shorter periods than those left untreated the drug would appear to have a definitely injurious effect upon guinea-pigs. Both tryposafrol and novo-tryposafrol were used in these experiments with similar results.

Novo-tryposafrol was used for the treatment of four dogs infected with *Piroplasma canis*, the treatment starting on the day of inoculation. All the dogs died, and three of them in a shorter period than the untreated control dog.

LEISHMANIASIS.

- (225) LAVERAN (A.). Comment le bouton d'Orient se propage-t-il? [The Transmission of Oriental boil.]—*Ann. Inst. Pasteur*. 1915. Sept. Vol. 29. No. 9. pp. 415-439.

This paper is a survey of the literature regarding various aspects of the transmission of oriental boil.

The first point dealt with is the inoculability of the disease. Then follows a summary of the literature dealing with the fact that the lesions often develop in connection with wounds. The third section of the paper is devoted to a summary of the papers published in connection with the part played by insects, and particularly the domestic fly, in the propagation of the infection. The final section deals with the question of an animal reservoir of the virus.

The following is a summary of the conclusions arrived at:— Oriental boil is transmissible to man and to various animals, and is also auto-inoculable. The lesions frequently develop in connection with wounds, and soiled linen may serve for the transmission of the infection. The fact that the lesions are most usually found on portions of the body that are not protected by clothes appears to indicate that the virus is transmitted by a flying insect. The possibility is suggested that biting insects, although not the direct agents of transmission may nevertheless play an important part in it, in that the irritating nature of the bites inflicted by them may lead to scratching and thus give rise to small wounds through which the virus may gain access. There is some evidence to show that the domestic fly may play a part in the propagation of the disease, as it does in the case of typhoid and other infections. But it appears that it only acts as a mechanical carrier.

There is a possibility that the dog may act as a reservoir for the virus in areas where leishmaniasis of the dog is common, but it is possible that there are several varieties of *L. tropica* and that the mode of transmission differs in different endemic areas. In this way the divergent views of observers working in different countries might be harmonised.

- (226) WENYON (C. M.). Flagellate Forms of *Leishmania donovani* in the Tissues of an Experimentally Infected Dog.—*Jl. Trop. Med. & Hyg.* 1915. Oct 1. Vol. 18. No. 19. pp. 218-219. With 1 text-fig.

This short note records the occurrence in the tissues of a dog inoculated with *L. donovani* of leptomonas forms simultaneously with the ordinary forms.

The dog in question was the fifth in a series, the first of which was inoculated with spleen pulp from a man who contracted the infection in Calcutta. The first inoculation was made in Sept. 1913. The animal from which the flagellate forms were obtained was inoculated intraperitoneally with spleen pulp from the preceding dog in the series, and was killed when on the point of death about five weeks later. The bone marrow showed numerous parasites, some of which were very large, measuring 8 or 9 microns in diameter. Together with these there were a few leptomonas forms, such as are obtained in cultures of the parasite on NNN medium.

The successful transmission of the parasite through five dogs appears to suggest that it can be carried on indefinitely in the dog.

- (227) SERGENT (Ed.), SERGENT (Et.), LEMAIRE (G.) & SENEVET (G.). Hypothèse sur le phlébotome "transmetteur" et la tarente "réservoir de virus" du bouton d'Orient. [A Theory regarding Phlebotomus as the Transmitting Agent, and the Tarantula as the Reservoir of the Virus of Oriental Boil.]—*Ann. Inst. Pasteur.* 1915. July. Vol. 29. No. 7. pp. 309-322.

This paper contains a fuller account of the authors' investigations, of which a description has already been published in the *Bulletin de la Société de Pathologie exotique*, and of which an abstract is given in this *Bulletin*, Vol. 2, p. 177. The present publication does not appear to add any information to that previously given.

- (228) SPAGNOLIO (G.). Die Leishmaniose bei Menschen und Hunden. Studium des Krankheitsgebietes. [Leishmaniasis in Man and in Dogs. A Study of the Distribution of the Disease.]—*Cent. f. Bakt.* I. Abt. Orig. 1915. Jan. 15. Vol. 75. No. 4. pp. 295-298.

From his clinical observations the author arrives at the conclusion that leishmaniasis occurs more commonly in the open country than in towns and, further, that the evidence does not warrant the view that dogs form the source of infection for children. A small number of cases are mentioned in support of these opinions.

The view is also put forward that the seasonal occurrence of the disease in man contraindicates that the infection is derived from the dog, and consequently that the dog flea does not play a part in its transmission from dog to man.

In the course of his observations the author has in no instance found any evidence of direct transmission of the disease from child to child. In no instance were there two simultaneous cases in children in the same family. It is the adult man that is generally affected, and this contraindicates the flea as the transmitting agent, as the women are far more frequently carriers of fleas than the males.

- (229) MACKIE (F. P.) The Presence of Leishmania in the Peripheral Blood of Kala-Azar in Assam.—*Indian Jl. Med. Research.* 1915. July. Vol. 3. No. 1. pp. 90-92. With 1 coloured plate.

The author has found peripheral infections in 21 per cent. of Assamese, and 64 per cent. of Indian coolies. The frequency with which the parasites were found in the blood was practically constant in all stages of the disease. The mononuclear cells were most frequently invaded, and single and multiple invasions were found.

- (230) WENYON (C. M.). Leishmania Problems: Observations on a Recent Contribution to the Subject.—*Jl. Trop. Med. & Hyg.* 1915. Nov. 1. Vol. 18. No. 21. pp. 241-247.

This paper is a reply to one by FANTHAM which appeared in the *Annals of Tropical Medicine and Parasitology*, 1915. Vol. 9. No. 2.

PROTOZOA.

- (231) CARINI (A.) & MACIEL (J.). Ueber *Pneumocystis carinii*. [*Pneumocystis carinii*.]—*Cent. f. Bakt.* I. Abt. Orig. 1915. Sept. 8. Vol. 77. No. 1. pp. 46-50. With 1 plate in colours comprising 26 figs.

After referring to the views originally expressed regarding the nature or identity of this parasite by a number of observers, all of whom were influenced to some extent by the view expressed by CHAGAS, that they represented a stage of gametogony of a trypanosome, the authors refer to the discovery of parasites having the same morphology in animals that were certainly free from trypanosome infection.

Pneumocystis has up to the present been discovered in guinea-pigs, hares, rats, rabbits, dogs, cats, goats, and sheep. Its occurrence in man is a matter of doubt.

With regard to its occurrence, it is stated that in Brazil ARAGAO found 8 rabbits out of 37 infected, 11 out of 46 guinea-pigs, and 2 out of 7 rats. The lungs appear to be the organs most usually infested. There is however no information as to whether all these species of animals are invaded by the same species of parasite.

In this connection the authors state that, while they have sometimes observed slight differences in different hosts, they do not think that these have any specific importance.

The parasites are not responsible for any marked lesions and, with the exception of one dog which had frequent attacks of coughing, none of the animals under the observation of the authors presented any symptoms indicating infection.

In preparations from the lungs stained with Giemsa the parasites appear as rounded or oval bodies measuring about 5 microns in diameter. There is a delicate capsule, which stains with eosin, enclosing 8 merozoites which have a bright red nucleus and a delicate blue-staining cytoplasm. The authors have never seen the blepharoplast described by CHAGAS. In most cases the merozoites are arranged in a radiating manner, but in some instances they appear to be disposed irregularly within the cyst. It would seem that all the stages of development occur in the lungs, as a number of stages in the process have been observed in preparations made from these organs.

No information is forthcoming as to the manner in which the merozoites make their escape from the cyst. These parasites have never been observed to possess more than one nucleus. After their escape they become rounded and increase in size. They are usually included within cells.

The authors were unable to find the parasite in the bronchial, tracheal, and pharyngeal mucus, and feeding experiments with heavily infested lung tissue failed to give positive results.

(232) DOBELL (C.) & JAMESON (A. P.). The Chromosome Cycle in Coccidia and Gregarines.—*Proc. Roy. Soc.* 1915. Aug. 2. Series B. Vol. 89. No. B 610. pp. 83-94. With 2 text-figs.

The authors have studied respectively the chromosome cycles in *Aggregata eberthi*, a coccidium which passes its life cycle in a cuttle-fish and a crab, and *Diplocystis schneideri*, a gregarine of the cockroach.

Aggregata eberthi.—The sexual generation of this parasite is passed in the cuttle-fish and the asexual generation in a crab.

In both the male and the female parasites there are six chromosomes, and in neither does the karyosome play any part in the formation of the chromosomes. Among the chromosomes of the male parasite can be distinguished a very long one and a very short one with four of intermediate sizes. This relationship of size is maintained throughout the mitoses. As in coccidia generally the macrogametocyte becomes a macrogamete without undergoing any process of division.

Before fertilisation the chromosomes break up within the nucleus of the macrogamete, and when fertilisation occurs a complex fertilisation spindle is formed. When the achromatic spindle has been formed for the first division of the zygote nucleus, the chromosomes become associated in homologous pairs, and at the metaphase these temporarily united chromosomes separate without any splitting. As far as

observations have gone the number of chromosomes appears to be constantly six, except just after fertilisation, the reduction occurring at the first division after fertilisation and not during the formation of the sexual forms.

Diplocystis schneideri.—The life history of this parasite is passed in a single host. At an early stage of development the parasites unite in pairs in the gut wall and fall into the body cavity of their host. They increase in size, and by repeated mitoses give rise to a large number of gametes. By the time the process is complete the partition dividing the gamonts has disappeared. When formation of the gametes is complete they fuse in pairs. The nucleus of the zygote gives rise to eight daughter nuclei which become the nuclei of the eight sporozoites developed within each spore. The sporozoites develop into body-cavity parasites in another cockroach.

In the nucleus of the gamont the vesicular karyosome gives rise to three chromosomes. These become constricted and divide, producing one large and two smaller chromosomes at each pole. At the second division they are globular, at the third stumpy, and at subsequent ones filamentar. At the metaphases they split longitudinally.

In the nuclear division of the zygote six chromosomes are formed. The daughter nuclei divide twice, and three chromosomes are visible at each division.

Reduction division therefore occurs immediately after fertilisation.

(233) STEVENSON (A. C.) & WENYON (C. M.). Note on the Occurrence of *Lankesteria culicis* in West Africa.—*Jl. Trop. Med. & Hyg.* 1915. Sept. 1. Vol. 18. No. 17. p. 196.

In the course of MacGREGOR's mosquito-breeding experiments, of which an abstract is given in this *Bulletin* (see abstract no. 244), the authors noted that some of the mosquitoes harboured *Lankesteria culicis* Ross 1898. This parasite had previously been recorded as occurring in India, South America, and Bagdad. Interest attaches to the discovery as showing the resistance of the parasite. It must have undergone the same amount of drying as the eggs received in this country, and the infection has passed through several generations of mosquitoes.

(234) de MELLO (F.). Preliminary Note on a New Haemogregarine found in the Pigeon's Blood.—*Indian Jl. Med. Research.* 1915. July. Vol. 3. No. 1. pp. 93-94. With 1 plate.

The parasite that is briefly described and figured in this paper, and to which the author gives the name *H. francoae*, has the following morphology :—

In the fresh state there can be made out a refractile nucleus situated in the centre of a mass of cytoplasm which has the appearance of a large vacuole. When at rest the parasite is rounded but slight movements within the invaded leucocyte produce changes in shape. The parasites vary in size from 3 to 7 microns in diameter.

In preparations stained with Giemsa the nucleus stains a brilliant red colour, and the cytoplasm faintly blue.

Schizogonous forms are frequently found in the liver, and occasionally in the blood and bone marrow. No such forms have been seen in preparations from the lungs.

In addition to schizogony the author has observed a process of binary division.

The pigeons found to be infected were infested with *Lynchia maura*, and it is suspected that the sporogonous stages of development occur in this insect, though they have not been found.

HELMINTHS.

(235) SWEET (Georgina). *Investigations into the Occurrence of Onchocerciasis in Cattle and Associated Animals in Countries other than Australia*.—54 pp. With 7 plates comprising 12 figs. 1914. Melbourne: Government Printer.

During the course of her tour the author visited Java, the Straits Settlements and Malay Federated States, Ceylon, India, Egypt, Europe, Great Britain, United States of America, Canada, and the Hawaiian Islands. In addition to the personal investigations and inquiries made in these places a certain amount of information was collected as the result of communications addressed to the officials in Burma, Siam, Annam, Southern China, and the Philippines.

The types of bovines considered in connection with the parasite were *Bos taurus*, under which name are included the common tame oxen of Europe and Northern Asia, *Bos indicus*, including the common domesticated humped cattle of India, and *Bos bubalis*, the water buffalo.

In view of the almost certain derivation of the Australian *Onchocerca gibsoni* from cattle imported from India or Malaya, it might have been expected that the parasite found in India would be identical with that occurring in Australia. Careful examination has, however, forced the author to conclude that the two are distinct species, and a new species, *O. indica*, has been made for the Indian parasite.

The full description of the Australian parasite has already been published and it is not repeated here, but a summary is given of the characters of the worm occurring in India.

The male parasite ranges from 3·38 to 9·3 cm. in length and from 0·175–0·220 mm. in diameter in the central portion of the body. The posterior end is often coiled, and the tail is curved ventrally immediately posterior to the cloacal swelling.

In the central portion of the body there are well marked transverse ridges, which are 0·005–0·006 mm. in width. These gradually become less distinct towards the extremities of the body. The mouth has three lips, and three papillae close behind the level of the opening. The oesophagus is about 1 mm. in length and has a well-defined bulb at its junction with the thin-walled straight intestine. The nerve ring is placed about 1·18 mm. from the anterior end, and the excretory pore is about 0·07 mm. behind this.

There are generally eight or nine pairs of anal papillae, but these are sometimes asymmetrical.

The spicules are unequal in length, measuring about 25 and 0·08 mm. respectively. The proximal end is funnel-shaped and the distal end pointed or slightly bifid. The short spicule is shoe-shaped at its distal extremity for the guidance of the longer spicule.

The female may be 100 cm. in length. For the greater part of the length the cuticle shows prominent wavy ridges, which may form an almost continuous single or double spiral round the body. No transverse ridges could be detected. The bulb of the oesophagus is generally less distinct than in the male, and no excretory pore could be seen. The vulva is placed on a slight swelling about 6 mm. from the anterior end. This leads into a thick walled vagina which is sometimes twisted.

All stages of development of the eggs were found in the genital tubes up to the free embryo. Imperfect preservation of these prevented exact histological examinations being made.

In the female worm the tail is markedly thinner than in *O. gibsoni*. In the specimens measured the oesophagus was longer.

No information was forthcoming with regard to the life-history of any of the parasites encountered.

The following tabular statement indicates the previous records of the occurrence of parasites belonging to this genus in cattle and associated animals, and the new records of their occurrence:—

Place.	Host animal.	Previous record.	Present record.*
Java	<i>Bos taurus</i> ..	<i>O. gibsoni</i> (De Does, &c.)	<i>O. gibsoni</i> (?)
"	<i>Bos indicus</i> ..	—†	<i>O. sp.</i> (?)
"	Hybrids of above	—	<i>O. gibsoni</i> (?) (subcutaneously)
"	<i>Bos bubalis</i> ..	—	<i>O. sp.</i> (?) (subcutaneously)
Sumatra	<i>Bos banteng</i> ..	—	—†
Sumatra	<i>Bos taurus</i> ..	—	<i>O. gibsoni</i> (?)
"	<i>Bos indicus</i> ..	—	<i>O. sp.</i> (?)
"	<i>Bos bubalis</i> ..	—	<i>O. sp.</i> (?) (subcutaneously)
Bali "	<i>Bos banteng</i> ..	—	—
Madura	<i>Bos taurus</i> ..	—	<i>O. gibsoni</i> (?)
Lombok	—	—	—
Timor	—	—	—
Poeloe Laoet ..	<i>Bos indicus</i> ..	—	<i>O. sp.</i> (?)
Philippine Islands ..	<i>Bos indicus</i> (?)	—	—
Hawaiian Islands ..	<i>Bos bubalis</i> ..	—	—
"	<i>Bos taurus</i> ..	—	—
"	<i>Bos bubalis</i> ..	—	—
Singapore	<i>Bos indicus</i> ..	—	—
"	<i>Bos bubalis</i> ..	—	—
Kuala Lumpur ..	<i>Bos indicus</i> ..	<i>O. gibsoni</i> (Daniels, Ford, Leiper)	<i>O. gibsoni</i>
"	<i>Bos bubalis</i> ..	—	<i>O. sp.</i> (?)
Penang	<i>Bos indicus</i> ..	—	<i>O. gibsoni</i>
"	<i>Bos bubalis</i> ..	—	<i>O. sp.</i> (?)
Malaya	<i>Bos gaurus hubbacki</i>	—	—
Siam	<i>Bos indicus</i> ..	—	<i>O. gibsoni</i>
Burma	<i>Bos indicus</i> ..	—	<i>O. sp.</i> (?)
"	<i>Bos bubalis</i> ..	—	<i>O. sp.</i> (?)

*For Notes see end of Table.

Place.	Host animal.	Previous record.	Present record.*
Assam	—	—	—
Bengal	—	—	—
Bihar and Orissa ..	—	—	—
Ceylon	<i>Bos indicus</i> ..	—	<i>O. indica n. sp. (?)</i>
" Madras	<i>Bos bubalis</i> ..	—	<i>O. indica n. sp. (?)</i>
"	<i>Bos indicus</i> ..	—	<i>O. indica n. sp.</i>
"	<i>Bos bubalis</i> ..	—	—
Central Provinces and Berar ..	<i>Bos indicus</i> (5 per cent.)	—†	<i>O. indica n. sp.</i>
Central Provinces and Berar ..	<i>Bos bubalis</i> ..	—	<i>O. indica n. sp.</i>
United Provinces of Agra and Oudh ..	<i>Bos indicus</i> (2-20 per cent.)	—	<i>O. indica n. sp.</i>
United Provinces of Agra and Oudh ..	<i>Bos bubalis</i> ..	—	<i>O. indica n. sp.</i> (subcutaneously)
Punjaub	<i>Bos indicus</i> ..	—	<i>O. indica n. sp.</i>
"	<i>Bos bubalis</i> ..	—	<i>O. indica n. sp.</i>
"	<i>Camelus bactrianus</i>	<i>O. fasciata</i> (Leese, Railliet)	—†
Sind, Baluchistan, and Rajputana ..	<i>Bos indicus</i> ..	—	—
Sind, Baluchistan, and Rajputana ..	<i>Bos bubalis</i> ..	—	—
Bombay Presidency ..	<i>Bos indicus</i> ..	—	—
Egypt	<i>Bos bubalis</i> ..	—	—
"	<i>Bos indicus</i> (?) ..	—	<i>O. sp. (?)</i>
"	<i>Bos bubalis</i> ..	—	—
"	<i>Camelus dromedarius</i>	<i>O. fasciata</i> (?) (Mason)	—
Sudan	<i>Bos indicus</i> (?) ..	—	—
"	<i>Bos bubalis</i> ..	—	—
Algeria and Tunis ..	<i>Bos taurus</i> (?) ..	<i>O. gutturosa</i> (Neumann)	—
Italy	<i>Bos taurus</i> ..	—	—
Austria	"	—	—
Germany	"	—	—
Denmark	"	—	—
Switzerland	"	—	—
France	"	<i>O. bovis</i> (Piettre) not nodule forming	<i>O. bovis</i>
Great Britain ..	"	—	—
United States of America ..	"	<i>O. (?) lienalis</i> (Stiles) in capsule of spleen	—
United States of America ..	<i>Bos indicus</i> and hybrids ..	—	—
South America ..	<i>Bos taurus</i> ..	—	—
"	<i>Bos indicus</i> and hybrids ..	—	—

* The mark (?) in this column indicates that, although I have now evidence of the existence of the nodules as indicated, either the material available is useless for exact specific determination, or else material for this purpose is not yet in hand.

† The mark — indicates that such nodules are as yet unknown in these cases.

The limitations of the species found appear to be geographical; thus—*O. gutturosa* is characteristic of Northern Africa, *O. indica* is found in India, and *O. gibsoni* in *Bos indicus* in the Malay Archipelago. It is probable that the parasite was introduced into Australia from the last of these areas.

In an addendum it is stated that the author has received nodules from three Indian buffaloes, an animal which at the time of writing the main portion of the report had not been found to be infected.

In some cases there may be no true capsule in these lesions, there being only a small amount of white fibrous tissue forming bundles which emerge from the worm area and mingle with the subcutaneous tissue.

The report contains a full bibliography and a large number of tables giving detailed information regarding the measurements of the parasites.

(236) MCEACHRAN (J. F.) & HILL (F.). Investigations into the Cause of Worm Nodules (*Onchocerca gibsoni*) in Cattle, at Darwin, Northern Territory, Australia.—8 pp. 1914. Commonwealth of Australia. Melbourne: Government Printer.

In the slaughter house at the Dairy, Darwin, practically every bullock and cow examined showed nodules in the brisket. Insufficient experience prevents the authors from making any definite statement regarding the occurrence of the parasite in the buffalo, but no parasites could be found in six animals examined.

GILRUTH's conclusions regarding the practical absence of reinfection after a certain age, and the tendency for the nodules to become smaller and finally disappear have been confirmed.

The apparent absence of infection in the buffalo suggests that whatever the intermediate host may be, it is one that attacks the ox but not the buffalo.

In order to test the views that have been put forward regarding the occurrence of an intermediate host, five heifers were obtained from Victoria, where the worm rarely occurs in locally bred animals.

No precautions were taken during the voyage and it is probable that the animals were bitten by *Stomoxys calcitrans*, mosquitoes, and perhaps Tabanidae.

On arrival two of the animals were placed in a pen which had been rendered as fly proof as possible, and two others in an open pen adjoining it. The remaining calf was placed with 15 dairy cattle, of which eleven had well developed nodules.

Examination of the calves and of their blood failed to show either nodules or embryos.

A list is given showing the flies, mosquitoes and ticks that have been found on cattle at Darwin, Fannie Bay, and in the vicinity, together with a note as to their seasonal occurrence.

Lyperosia exigua (buffalo fly) greatly outnumbers all the other species and causes the cattle the greatest annoyance.

Stomoxys calcitrans was numerously present, especially near the pens. Whereas *Lyperosia exigua* attacks nearly all parts of the body, *Stomoxys calcitrans* appears to have a preference for the flanks, brisket and legs.

In the first experiment, one of the imported calves was allowed to run with the infected dairy animals, and a locally bred calf served as a control.

The animals were allowed to be in contact for six months.

Three small nodules about the size of peas were found in the brisket of the former animal, and five in the latter. No nodules were found in any other part of the body.

The two calves which were placed in the open pen were observed to be attacked by two species of Tabanidae, by *Stomoxyx*, *Hyperosia*, and *Haematopinus tuberculatus*. The infected dairy animals were often in close proximity to the pen but never in actual contact with the calves in it.

When these calves were killed after seven months no evidence of infestation was found in either.

The two calves which were placed in the screened pen were not kept entirely free from insects as it was found that *Culicela vigilax* was capable of passing through the mesh of the wire netting and the calves were observed to be bitten by them.

A few specimens of *Musca domestica* and *Pycnosoma dux* were able to gain access to the pen with the attendant, but they did not remain for more than a day or two.

When the calves were slaughtered at intervals of seven and eight months respectively they were found to be free from infestation.

Experiments with captive Tabanidae were not very successful, as only one species, *T. gregarius* (?), could be got to feed from the summit of a shaved nodule. The other flies used preferred to feed upon the skin surrounding the nodule, even after the hair covering it had grown again. The one fly which fed freely upon the nodule was starved for eight days after it had fed, save for a small meal of honey and water, and it was then carefully examined. The result was quite negative.

Two hundred and thirty-seven flies of different species and lice were examined but in every instance they were quite free from parasites.

Interestng details are given regarding observed facts in the life-history of *Haematopinus tuberculatus* (the buffalo louse). The tail appears to be the only part of the animal invaded. The adults lay the eggs near the tip. The larvae pass up the dorsal surface of the tail until near the root and then pass to the under side where they remain until the nymphs are about half grown. It would appear that at this stage the parasite drops to the ground and completes its development there.

On the swamp buffalo the parasite may be found on practically any part of the body, but the tail, anus, and escutcheon, where the parasites are specially numerous in cattle, are less invaded than other parts.

(237) LANE (C.). A Further Note on Bursate Nematodes from the Indian Elephant.—*Indian Jl. Med. Research.* 1915. July. Vol. 3. No. 1. pp. 105-108.

In this paper the author reconsiders the generic and specific names for nematodes found in the Indian elephant which were put forward in

his previous communication. This revision is necessitated by the prior publication of papers dealing with the same subject by RAILLIET, HENRY, and BAUCHE.

Equinuria sipunculiformis.—Although termed *Cylicostomum sipunculiforme* by the French authors in their paper, RAILLIET in a private communication expresses his opinion that the parasite should stand as the type of the new genus.

Asifia vasifa.—This name lapses as it was used to designate the parasite named *Choniangium epistomum* by RAILLIET, HENRY and BAUCHE.

Decrusia additicia.—The author maintains that this name should stand, the reasons for the removal of the parasite from the genus *Strongylus* having been given in the previous paper.

Murshidia murshidia and *Murshidia falcifera*.—The author thinks that his genus should stand, as the parasites belonging to it differ from *Cylicostomum*, in which genus the latter parasite is placed by the French observers.

The genus *Quilonia* Lane must apparently be allowed to lapse in favour of *Evansia* Railliet and Henry.

RAILLIET grants the validity of the genus *Amira*.

The author records a case of death in an elephant, which was apparently due to the presence of millions of *Murshidia murshidia* in the small intestine.

(238) LEIPER (R. T.). Report on the Results of the Bilharzia Mission in Egypt, 1915.—*Jl. Roy. Army Med. Corps.* 1915. July. Vol. 25. No. 1. pp. 1-55. With 22 text-figs.; Aug. No. 2. pp. 147-191. With 16 text-figs.

Part I. The first twenty pages or so of this report contain a historical survey of the subject. The views that have been expressed regarding methods of infection and the work that has been done in searching for an intermediate host are very fully dealt with. The incidence of the disease is a matter upon which it has until recently been difficult to obtain any exact information, but it appears from figures obtained by MACCALLUM, which the author is able to give, that in different districts the percentage of people having eggs in their urine ranges from about 40 to 70.

The programme of work laid down by the Mission was as follows:—

All fresh-water molluscs that could be found within half a day's journey of Cairo were to be collected and identified. Large numbers of all the species found were to be dissected and examined for trematode larvae. The larvae having morphological characters peculiar to the bilharzia group were to be differentiated from each other. Experiments were to be made to ascertain whether any species of mollusc showed chemiotactic attraction for bilharzia miracidia. Attempts were to be made to infect with cercaria animals brought from England; to ascertain by what path infection took place, and the period of incubation; to study the bionomics of the mollusc and of the cercaria, and particularly the effects of acids and other substances on the latter.

In areas of water in the Zoological and Botanical Gardens at Giza the whole series of molluscs described, with a few special exceptions, was found.

With the object of making a study of the molluscs in the neighbourhood a village, El Marg, was selected as a suitable place, as it was easy of access, without a birket, and was on a small canal coming off almost directly from one of the main supply canals. In its course from the Taufiqia canal to and through the village of El Marg the canal is open to much contamination and an examination of single drops of urine passed by 54 boys, most of whom were under 12 years of age, showed that 49 were infected. The urine was not allowed to sediment nor was it centrifuged. It was therefore determined to make a thorough examination of all the molluscs occurring in this canal.

Owing to the facts that during the summer months the flow of water in the canals is controlled by the Government, allowing 6 days' flow and 15 days' stoppage, and that during the latter periods the canal became dry, the author was able to collect with little chance of missing any all the species of molluscs occurring there.

In examining the species collected two methods were adopted. In the first the molluscs were placed in dishes of clean water for a few days, during which period the cercarial forms were in many cases discharged, and could be seen with a hand lens. In other cases the molluscs were dissected. Those with hard shells were crushed and then torn apart on a slide with a little water or some weak formalin. The soft shelled species could be torn open with needles.

In the course of the investigation seventeen species of trematode larvae were identified, and several new species found.

In addition to the fact that in the adult bilharzia worms the sexes are separate, there is also a complete absence of a definite pharyngeal bulb at the commencement of the oesophagus. "As in all parasitic worms the infective stage shows no sexual differentiation, consequently the absence of the pharynx in the cercaria is the one reliable character upon which a bilharzia cercaria can be distinguished from the cercariae of other distomes, because the body of the cercaria without further metamorphosis grows to become the body of the adult worm."

The cercarial tail is always shed before the parasite gains access to the tissues of the final host. The tail in the four bilharzia cercariae which were found by the authors was forked at its free end, but this character is not distinctive, as it is shared by other forms of distomes.

Most of the species of snails experimented with showed no attraction for the miracidia of bilharzia, but definite attraction was exhibited by *Planorbis boissyi*, *Bullinus* sp. (?), *Pyrgophysa forskali*, and *Limnaea truncatula*. This attraction was stronger in young specimens. It is noted that *Limnaea truncatula* could not be found at Marg.

Molluscs infected with larvae showing the characters of the bilharzia group were found in the canal in or near the village, but the same species of snails found in the agricultural drains at some distance from the village were not infected.

Three cercariae of the bilharzial type were found in four different species of snails. The first showed two black pigment spots just anterior to the ventral sucker, and a well defined cuticular expansion on each side of the two prongs of the bifid tail. This form occurred in *Planorbis mareoticus*, and apparently also in *Melania tuberculata*, and *Planorbis boissyi*. The second form occurred in *P. boissyi* at Marg and other places. A few cercariae apparently identical with this were obtained on one occasion from *Melania tuberculata*. A third species,

which was provisionally distinguished from that occurring in *P. boissyi*, was also found at Marg in a number of specimens of *Bullinus*.

Three species of bilharzia are supposed to occur in Egypt; one of these, of which there are two varieties, is parasitic in man, one in cattle and one in ducks. The facts that have been ascertained appear to indicate that the cercaria with eye spots and bifid tail may be that of the parasite of the duck, as similar cercariae have been found in Central Europe and North America. This parasite is *Bilharziella polonica*.

Attempts were made to infect a calf and a lamb by allowing water containing large numbers of cercariae to remain in the hollows of the groin for from ten to thirty minutes on several days. The results were entirely negative, although it was noted that the skin of the lamb became red where it was repeatedly exposed to infection. Experiments with mice, rats, geese, ducks, chickens, crows, and wagtails gave entirely negative results as far as the birds were concerned. A mouse and a rat were successfully infected. These animals had been brought from London, and had been kept under conditions which absolutely excluded the possibility of natural infection.

It was found that *Schistosoma haematobium* and *S. bovis* were so closely allied that in the experimental mice and rats the difference could be detected with certainty in the adult worms only. In animals which survived seven weeks females were found containing the characteristic eggs, and then the diagnosis was placed beyond doubt.

In addition to white rats and variegated mice, the desert rat and the guinea-pig were found to be susceptible to infection, especially the latter. A Mangabey monkey died in two months from acute infection. No experiments were made with dogs owing to the difficulty presented by the quarantine regulations for the importation of dogs into England.

To ascertain the mode or modes of entry of the parasite into the body an experiment was carried out with four sooty monkeys taken out with the Mission. These were placed in separate cages, and free from all chance of accidental infection. Infested water was placed in the bottom of the cages of three, so as to allow infection through the skin, and the fourth was given heavily infested water to drink. All four died and showed severe infections.

In experimentally infected monkeys, the period of incubation was found to be between one and two months.

Part II. In this portion of the report the author deals with the following points:—Water in relation to the spread of the infection, including methods of irrigation, subsoil water, and rainfall; the prevention of infection in towns and agricultural districts; suggestions for eradication.

He points out that the disease appears to have spread since perennial irrigation was adopted. This is partly accounted for by the increased liability to infection, but more particularly to the more favourable environment created for the intermediate host.

In attempting to control the disease some means must be found to break the life cycle of the parasite. This may be done either by destroying it during the infective stage (free-swimming stage) or by depriving it of its essential intermediate host. The former means appears to be more suitable for application in towns, and the latter

In view of the fact that the cercariae do not live in water for more than 36 hours, the danger from unfiltered water would be obviated if it could be stored for a rather longer period than that. Opposition would be raised to this plan, as it would be also to the filtration of all water used in Cairo, because both measures would deprive the water of its manurial value, and the gardens of the town would suffer. Against this is set the fact that under present conditions about 10,000 children become infected annually in Cairo.

The varying condition of the Nile at different periods of the year, and the rate of the flow at different seasons are brought under consideration, and from the information gained deductions are made as to the distance up the river that contamination of the water may occur and still remain viable by the time it reaches Cairo.

In agricultural districts the conditions obtaining in the canals and ditches make these suitable places for the intermediate hosts, and as the people are constantly exposed to infection from this water in the course of their work, preventive measures in such districts should be aimed at the molluscs.

A method of eradication which appears to be applicable to Lower Egypt, save in the rice growing districts, depends upon the "rotation" supply of the water from April to August. During the stoppages of the water for periods of 15 days the canals become dry, except for occasional puddles. *Planorbis* and *Bullinus* taken from the dry beds did not revive in water, and of those in the puddles the former appeared to be more hardy than the latter. Had the canals been so constructed that no puddles remained in the dry periods, the intermediate hosts would have been destroyed automatically just at the commencement of the period of their greatest reproductive activity.

The puddles could be treated with some chemical agent suitable for the destruction of the molluscs, but at the same time not injurious to the crops, as the water would be carried on to the land at the commencement of the rotation following. It was found that ammonium sulphate, which is used as a manure, was fatal to the molluscs in a weak solution within a few hours. This, therefore, could be used with safety and without ultimate loss.

The small drains frequently become overgrown with weeds and afford sufficient shelter to the molluscs to enable them to survive for a considerable time. The canals are usually closed for a month during the latter part of December and the early part of January to allow of the removal of silt. If the cleaning could be carried out in the early summer in conjunction with the rotations of water the elimination of the intermediate hosts of the parasite would be assisted.

A consideration of the sowing and harvesting of the various crops grown in Lower Egypt shows that, with the three years' rotation that is generally practised, two-thirds of the land is bare fallow during June and July, and the remainder under cotton.

At the same time the climatic conditions are also the most favourable for a campaign against the carriers of bilharzia. The land in use for cotton could possibly be so arranged that in a given area only one-third was in use. The canals supplying the remaining two-thirds would become quite dry, and the molluscs would be killed off. The screening of those supplies in use would be of further assistance.

The thorough drying of the fallow land during June and July would have the additional advantage of killing off the cotton worm to a very large extent.

The questions arising as to the most suitable places for villages with regard to the canals and drains, and the best methods of draining are dealt with.

The Bionomics of *Bilharzia cercariae*.—

On any surface the cercariae move by alternate use of the ventral and oral suckers. When swimming they move with the tail foremost, periods of rest alternating with periods of swimming. They rapidly attack animals immersed in water, and in one case a young mouse which was placed in infested water for ten minutes contracted the infection.

The cercariae will not live for 48 hours in ordinary tap water, but many survive for 36 hours. Infected molluscs may continue to discharge cercariae into water for periods amounting to weeks. Cercariae cannot withstand the slightest desiccation, and deprivation of oxygen is rapidly fatal. They are immediately killed if the water containing them is raised to 50° C., but they can resist a temperature of 45° C.

Very weak solutions of alkalis stimulate the cercariae, while very weak acids inhabit them. It is seen from a table given that they are readily killed by weak solutions of antiseptics and essential oils.

From the observations made it would appear that infection is by no means limited to the autumn, but may be contracted during the greater part of the year.

Free swimming cercariae are able to pass through a fine silk mesh, stocking material, and in time through several inches of sand if there is a current of water running through it. They are arrested by filter paper.

(239) BOUILLIEZ (M.). *Les bilharzioses dans le Moyen-Chari (Territoire du Tchad). Recherches expérimentales.* [Bilharziasis in the Middle Chari, Chad Territory. Experimental Investigations.]—*Bull. Soc. Path. Exot.* 1915. Oct. Vol. 8. No. 8. pp. 604–610.

There can be little doubt that bilharziosis occurs both in children and in adults throughout the whole Territory. The symptoms are very slight and it is only exceptionally that infected persons present themselves for treatment.

The percentage of children infected with *S. haematobium* was 59, and in one case *S. mansoni* was found.

A number of experiments were carried out in which attempts were made to transmit the infection to animals, but in every case a negative result was obtained. Monkeys, wild cats, and dogs were used and attempts were made to infect them by way of the mucous membranes of the genital organs, through the skin, through skin wounds, and by feeding.

That an intermediate host is necessary does not appear to be very probable, in view of the close relationship that exists between *S. haematobium*, *S. mansoni*, and *S. japonicum*.

Experiments have shown that eggs may contain living embryos after 6 to 8 hours' immersion in 1 in 500 hydrochloric acid, and the authors think that infection may possibly occur by way of the intestinal tract.

Efforts have been made to find a successful method of treatment, but so far satisfactory results have not been obtained. Methylene blue, which appeared to give good results, does not affect the adult parasites. Neosalvarsan and emetine hydrochloride have both failed to yield good results.

(240) WATKINS-PITCHFORD (W.). Note on Schistosomiasis.—*Med. Jl. S. Africa.* 1915. July. Vol. 10. No. 12. p. 226.

The author states that CAWSTON (F. G.) has placed *Physopsis africana* obtained from the swimming pool at Pietermaritzburg in water to which a small quantity of urine obtained from bilharzia patients was added. At the end of three weeks cercariae were found encysted in the liver of one of the snails. The appearance of these cercariae and of the sporocysts containing them agreed with the illustrated description given in LEIPER's communication regarding *Schistosoma japonicum*.

(241) CIUREA (J.). Un Echinostome dans l'Intestin du Porc. [An Echinostome in the Intestine of the Pig.]—*Cent. f. Bakter. I. Abt. Orig.* Vol. 75. No. 5/6. Feb. 15. 1915. pp. 392-394. With 1 text-fig.

The author states that he has found in the intestine of a young pig, which had been fed for two months upon fish, four adult echinostomes which he considers to be identical with *Echinocasmus perforatus*, described as occurring in the dog and the cat.

The following are the principal features of the parasite:—

The body, which is elongated tapering slightly towards each end, is more or less flattened, especially in the anterior part. The length varies from about 2 to 3·25 mm. and the breadth from 0·4 to 0·75 mm. The anterior extremity shows an adoral disc from 0·2 to 0·3 mm. in diameter, which has a gap in it on the ventral side. Laterally each half of this disc shows 12 small rod-like structures. These measure from 0·037 to 0·044 mm. in length and 0·013 in thickness at their bases.

The surface of the body is covered with scales which are triangular in shape with the apex directed backwards. These scales disappear at about the level of the posterior testicle.

The buccal sucker measures from 0·09 to 0·13 mm. in diameter and the ventral sucker is nearly twice that size.

The genital pore opens immediately in front of the ventral sucker. The testicles are placed one in front of the other near the middle of the body, and are more or less oval in shape.

The globular ovary is situated above and to the right of the anterior testicle, and below and to the left of this is the shell gland. The vitelline glands occupy the whole of the posterior portion of the body and extend up on either side to the level of the ventral sucker.

The uterus contains only a few eggs, which measure 0·092 to 0·11 mm. in length and 0·05 to 0·07 mm. in width.

- (242) SKRJABIN (K. J.). *Beitrag zur Kenntnis einiger Vogelcestoden* [Description of Certain Cestodes of Birds.]—*Cent. f. Bakteriol. I. Abt. Orig.* 1914. Aug. 29. Vol. 75. No. 5/6. pp. 59-83. With 42 text-figs.

In this paper the author describes a number of cestodes obtained from the Museum of Natural History, Berlin, and from the Göteborg Museum.

The following is a list of the parasites dealt with :—

A. Anoplocephalidae :

1. *Aporina fuhrmanni* n. sp.
2. *Cittotaenia columbae* n. sp.

B. Davaineidae :

3. *Davainea laticanalis* n. sp.
4. " *cyrtus* n. sp.
5. " *emperus* n. sp.
6. " *galeritae* n. sp.
7. " *paradisea* Fuhrmann.
8. *Chapmania unilateralis* n. sp.

C. Dilepididae :

9. *Uncinuria trichocirrosa* n. gen. n. sp.
10. *Anomotaenia socialis* Krabbe.

D. Hymenolipidae :

11. *Hymenolepis flaminginis* n. sp.

E. Acoleidae :

12. *Progynotaenia fuhrmanni* n. sp.
13. *Gyrocoelia brevis* Fuhrm.

- (243) GAIGER (S. H.). *Treatment of Nematode Diseases*.—*Vet. Record.* 1915. Sept. 18. No. 1419. pp. 128-130.

This article contains some criticisms of a paper by CRAIG presented at the Tenth International Veterinary Congress, London, 1914, and read before the National Veterinary Association of Ireland, May 20th 1915.

BITING FLIES.

- (244) MACGREGOR (M. E.). *Notes on the Rearing of Stegomyia fasciata in London*.—*Jl. Trop. Med. & Hyg.* 1915. Sept. 1. Vol. 18. No. 17. pp. 193-196.

The eggs from which the mosquitoes were obtained were sent from West Africa on some leaves of the West African cotton-wood tree. The leaves with the eggs attached to them had been at least three and a half months in a dried state. The majority of the eggs looked very shrivelled but some appeared to be normal.

The leaves were placed in tap water and left at room temperature. Within 24 hours the water was crowded with larvae. The number present indicated that some at least of the shrivelled eggs must have been viable.

By comparative tests it appeared that larvae kept in water at about 26° C., in which straw from horse manure had been placed as food, were the largest, and they also completed their metamorphoses most quickly. Those in water about 7° C. lower in temperature were nearly as good specimens, but they were three days longer in completing their development.

At the temperatures mentioned the average larval period was ten days, and the pupal period six days.

The males and females as they emerged were placed in small cages and were observed to copulate almost immediately.

It was found that they would feed upon a black guinea-pig but not upon a white one, and that they fed much more voraciously after their first meal of blood.

The males were observed to live from ten days to three weeks, and the females from a month to six weeks or even longer.

The females engorge themselves with blood in about five minutes, and apparently eggs require from three to five days after a meal to become mature. The eggs are deposited on the surface of water or attached to leaves in it. If the eggs are caused to sink by agitation of the water the majority of them do not hatch. Some of the females laid as many as eight batches of eggs.

The males do not suck blood as do the females, but they seem to take in minute quantities of sweat from the skin of a guinea-pig placed in the cage with them. Males will not approach a resting female, but if the females are disturbed the males at once approach them.

Pupation can be observed by placing the vessels containing the larvae in a fairly dark place. When pupation occurs the skin splits dorsally and the pupa emerges. The process is sometimes complete in 30 secs., but it generally takes longer.

When first hatched the larvae measure about 1 mm. long by 0.3 mm. at the greatest breadth, but after a few hours at 25° C. they are very much larger, and the head has enlarged and become dark in colour. When about to pupate they become opaque and of a yellowish colour.

The eggs are laid from three to five days after the female has fed, and at 30° C. they hatch out in about the same period, but in some cases the hatching is spread over a period of a week or more.

Attention is drawn to the possibilities opened up of *S. fasciata* being distributed very widely, either by leaves carried by the wind, or in bales of raw materials. The mosquito is so hardy that it might easily establish itself in countries where it is not at present known, and there have access to the virus of yellow fever.

The mosquitoes bred by the author have reached their sixth generation.

(245) BEQUAERT (J.). Note rectificative concernant les Auchmériomyies du Congo. [A Correction regarding the Auchmeromyia of the Congo.]—*Bull. Soc. Path. Exot.* 1915. Oct. Vol. 8. No. 8. pp. 593-594.

In the July number of the *Bulletin de la Société de Pathologie Exotique* the author recorded the capture of *Auchmeromyia (Chaeromyia) chaerophaga* Roub. in the Congo. Examination of the insect has shown that it is in reality *Cordylobia anthropophaga*.

EPIZOOTIC LYMPHANGITIS AND SPOROTRICHOSIS.

- (246) MEYER (K. F.). *Epizootic Lymphangitis and Sporotrichosis. (Studies on American Sporotrichosis II.)—Amer. Jl. Trop. Dis. & Prevent. Med.* 1915. Sept. Vol. 3. No. 3. pp. 144-163.

After dealing at some length with the controversy regarding the nature of the parasite that is responsible for epizootic lymphangitis and its staining reactions, the author states that he has been able to confirm the results published by BRIDRÉ and NÈGRE in 1910 showing that the complement fixation test can be applied to the diagnosis of the epizootic lymphangitis.

Two experiments of this nature were carried out before the author left South Africa. As antigen the suspected parasites were used. These were separated from pus by antiformin and suspended in carbolised salt solution. In a tabular statement the quantities of the various elements used in the tests are given.

Both sera gave positive results with the cryptococcus and negative results with *B. mallei*, *B. nephritidis equi*, and *B. pseudotuberculosis rodentium*.

Further tests were carried out with two sera received from Jamaica in 1912, one from a horse and one from a mule. These gave positive results with the cryptococcus. It is said that fixation was also obtained with suspension of "*Blastomyces equi*, *B. bovis*, blastomycotic sporothrix, and baker's yeast." Negative results were obtained when various bacilli were used as antigen. Uniform results could not be obtained when the sera were tested with *Sp. schencki-beurmanni*.

From a tabular statement given it would appear that exactly parallel results were obtained with the organisms mentioned above when they were used as antigen for sera derived from a case of epizootic lymphangitis and from a case of sporotrichosis in the human subject.

It is also stated that in one experiment epizootic lymphangitis serum gave complete haemolysis when a saline suspension of *T. equiperdum* was used.

Sporotrichosis is thought to have been introduced into the United States from Cuba at the time of the Spanish American war, but no careful study of the disease was made until 1910. It is pointed out that sporotrichosis differs from epizootic lymphangitis in the following respects :

It is not confined to tropical and subtropical zones, whereas epizootic lymphantitis is, except when it is accidentally introduced into a temperate climate. It has no seasonal distribution. It is not contagious; cases of sporotrichosis are always sporadic. It is rarely fatal. The parasite is very scantily present in the pus, and a definite diagnosis cannot be based upon microscopic examination. Such organisms as are present are in the form of short mycelia and not spores. They vary in length from 2 to 10 microns and in breadth from 1 to 3 microns. The membrane is thinner than in the case of the cryptococcus, but it is resistant to caustic potash and acetic acid.

It is said that budding forms have never been observed. The organism is more Gram-fast than the cryptococcus, but with Giemsa the appearances presented by the two organisms are very similar.

The reddish material present is thought to be metachromatic and not nuclear in nature. With iron haematoxylin a very small granule could always be detected in the centre of the metachromatic material. In sections, and especially those from old lesions, the organisms tend to lose their power of retaining Gram's stain. The author cannot confirm PAIGE and FROTHINGHAM's statement that the organisms are more numerous in ruptured lesions.

The spirothrix is easily cultivated, and this is the best method of arriving at a diagnosis.

The administration of iodin intravenously, it is not stated in what form and in what dose, effects a rapid cure of sporotrichosis, and the administration of the same drug per os also gives good results.

The disease is rarely transmitted from animals to man.

RABIES.

(247) AMATO (A.). *Ueber die Speicheldrüsen bei Lyssa.* [The Salivary Glands in Rabies.]—*Cent. f. Bakteriol.* 1. Abt. Orig. 1915. July 22. Vol. 76. No. 6. pp. 403-409. With 1 plate in colours comprising 13 figures.

The investigations recorded in this paper have been carried out on the parotid and submaxillary glands of rabbits infected with the fixed virus.

The parotid gland.—There appears to be an increase in the amount of connective tissue present in the gland, but in reality this increase is due to an oedematous infiltration of the tissue. It is only here and there that there is any cellular infiltration. The epithelium lining the ducts is generally normal, but in some cases it appears to have been shed into the lumen of the tubes. The cells not infrequently have a vacuolated appearance, but the author has never been able to demonstrate any fat in them. In one case the author observed a complete structural alteration in one lobule of the gland. This lobule had the appearance of a large space divided up into a number of cavities by septa of fibrous tissue, the cavities being filled with enormous numbers of mononuclear leucocytes, intermixed with phagocytes and red blood corpuscles. Among these could be made out rather indistinctly a number of the parenchyma cells. The outlines of the cells were vague and their nuclei were vesicular.

The alterations present in the submaxillary gland were like those present in the parotid, but they were generally rather more marked.

In both glands the author has observed in the epithelium lining the acini and in that shed into the lumen of the ducts, and also in some cases free in the ducts, rounded, oval, or irregularly three-sided bodies of which he gives a detailed description. Some of these bodies showed one or more vacuoles in their substance, while others appeared to contain a variable number of granules of different sizes arranged in various ways.

In the author's opinion the secreting epithelium becomes increasingly granular until the cells are packed with granules. Then vacuoles make their appearance, and these undergo a marked increase in size, thus producing the vacuolated appearance of the cells already referred to.

The rounded or oval bodies seen by the author stained red with Mann's stain, and were of a deeper tint than the surrounding cytoplasm. These bodies bore a marked resemblance to Negri bodies.

The structures which showed no bodies included within them are, in the author's view, evidence of a kind of condensation of protoplasm. He believes that the cellular inclusions observed represent some degenerative or secretory change.

The author ventures to doubt the parasitic nature of the structures resembling Negri bodies recently described by a number of authors as occurring in the salivary glands.

- (248) FERMI (C.). *Pouvoir immunisant de la substance nerveuse rabique d'animaux (poulets, canards, oies) dont la substance nerveuse normale est privée du pouvoir immunisant. Mécanisme de l'immunisation rabique. III. Note.* [The Immunising Power of the Rabic Nervous Tissues of Animals (Fowls, Ducks, Geese), the Normal Nervous Tissue of which is Devoid of Immunising Power.]—*Cent. f. Bakt.* I. Abt. Orig. 1915. July 22. Vol. 76. No. 6. pp. 434-436.

Having shown that a mixture of rabic virus and rabic nervous tissue is not always capable of producing immunity because (1) either the grey matter or the white matter alone possesses practically no immunising power as compared with that possessed by the two substances together, and (2) because the vagus and sympathetic and ischiatic nerves are practically devoid of any immunising properties, the author investigated the immunising properties of the rabic central nervous system of animals the normal nervous tissue of which is devoid of any immunising properties. For this purpose he selected the fowl, duck, and goose and tested their power of immunising mice and rats.

Details of the experiments are given in tabular form and the conclusions drawn are as follows :—

1. Rabic nervous tissue of the chicken and the goose when made into a five per cent. emulsion in 1 per cent. phenol is practically inactive. Only 20 per cent. of the mice appeared to be protected by the former and 29 per cent. of the rats injected were protected by the latter. The animals received two daily injections subcutaneously of 1 cc. and 0.25 cc. respectively for fifteen days.
2. Rabic nervous tissue derived from a duck failed to protect any of the 8 mice used in the experiment.

- (249) FERMI (C.). *Pouvoir immunisant et lyssicide des nucléo-protéides des substances nerveuses et normales, des substances blanches et grises séparées, de la substance testiculaire, du jaune d'œuf et des testicules du mouton. Mécanisme de l'immunisation rabique. IV. Note.* [The Immunising and Anti-rabic Properties of the Nucleo-protein Substances of Normal Nervous Tissue, the White and Grey Matters separately, Testicular Substance, Egg Yolk, and Sheep's Testicles.]—*Cent. f. Bakt.* 1915. July 22. Vol. 76. No. 6. pp. 436-441.

The author's conclusions drawn from the experiments, the details of which are given in tabular statements, are as follows.

1. The nucleo-proteids obtained from the brain tissue of a normal sheep in a first experiment was shown to possess anti-rabic properties to the extent of rendering 1 cc. of a 1 per cent. emulsion of fixed virus inactive in a dose of 0·2 cc. when injected subcutaneously.

In a second experiment it was found to be active, but incompletely in a 5 per cent. dose.

2. Nucleo-proteids obtained from the white and grey matters separately either from the sheep or the ox were found to be entirely devoid of any anti-rabic properties, because a mixture of equal parts of these failed to neutralise a 1 per cent. emulsion of fixed virus.

3. The nucleo-proteids of egg yolk and sheeps' testicles were found to be similarly devoid of any protective power.

(250) FERMI (C.). *La virulence, respectivement la dose minima mortelle de la salive et des glandes salivaires rabiques comparée à celle de la substance nerveuse rabique. Contribution au mécanisme de l'immunisation rabique.* [The Relative Virulence of the Saliva, the Salivary Glands, and the Nervous Tissue in Rabies.]—*Cent. f. Bakt.* I. Abt. Orig. 1915. May 20. Vol. 76. No. 2/3. pp. 178–183.

In testing the virulence of the saliva of dogs affected with street rabies, dilutions ranging from 1 in 1,000 to 1 in 50,000 were used, and of these dilutions 0·25 cc. was used for the inoculation of mice, either subcutaneously or into the eye. In the first experiment no dilutions between 1 in 1,000 and 1 in 10,000 were made, and only the mouse receiving the former succumbed. In later experiments the dilutions producing a fatal result ranged up to 1 in 6,000.

Working on similar lines with a 1 per cent. emulsion of submaxillary gland, from a dog dead of street rabies, made up with 5 per cent. carbolic acid, a similar result was obtained. In view of the fact that the amount of solids present in the salivary glands is thirty-six times as great as that present in the saliva, the latter is far more virulent than the former (36 times).

The minimal lethal dose of nervous tissue both of fixed virus and of street virus in the dose mentioned was in dilutions of 1 in 50,000 to 1 in 70,000. As the total solids in the nerve tissue are about equal to those in the salivary glands it follows that the nerve tissue is ten times as virulent as the gland tissue.

Calculating in the same way the author arrives at the conclusion that the saliva is 24 times as virulent as the nerve tissue.

(251) FERMI (C.). *Pouvoir immunisant de la salive et des glandes salivaires rabiques, c'est-à-dire, du virus isolé de la substance nerveuse.* [The Immunising Properties of the Saliva and Salivary Glands of Rabid Animals.]—*Cent. f. Bakt.* I. Abt. Orig. 1915. July 10. Vol. 76. No. 5. pp. 349–356.

The author finds that repeated injections of saliva from dogs infected with street virus containing 1 per cent. carbolic acid, are without effect for the protection of animals previously inoculated subcutaneously with street rabies. The same negative results followed the use of a five per cent. emulsion of salivary glands in salt solution containing 1 per cent. carbolic acid.

MISCELLANEOUS.

- (252) MARTOGLIO (F.). *Sulla tecnica per la produzione del siero contro la peste bovina. Utilizzazione del liquido di lavaggio vasale come antigeno.* [The Technique of the Production of Rinderpest Serum. Utilisation as Antigen of the Liquid obtained by washing out the Blood Vessels.] — *Memorie dell'Istituto Siero-Vaccinogeno Eritreo, Asmara.* 1915. July 15. No. 1. pp. 1-24.

The author refers at some length to the various methods that have been tried at different times with the object of increasing the amount of antigen obtainable from infected animals. He found that the serum obtained by the method described by HOLMES of using peritoneal washings as antigen was not so satisfactory as that obtained when blood was used. He therefore devised a means by which a considerable quantity of the blood ordinarily remaining in the vessels when an animal is bled to death could be made available for use as antigen. This method involved the partial bleeding of the animal, followed by an intravenous injection of salt solution, the animal being subsequently bled to death.

The following are the details of the method :—

On the fourth or fifth day, when lesions of the buccal mucous membrane have developed, the jugular vein is placed in connection with a vessel containing salt solution, the tube being closed by a pinch-cock, and the carotid is placed in connection with a vessel for the reception of blood. When the pre-agonal symptoms begin to make their appearance the bleeding from the carotid is stopped and salt solution is allowed to flow into the jugular. The symptoms gradually abate, and by the time an amount of salt solution equal to the amount of blood withdrawn has been allowed to pass into the jugular the animal is quite calm again.

The introduction of salt solution is not stopped at this point, as if that is done the amount of blood obtained at the second bleeding is small. The author's practice is to introduce about two and a half times the volume of the blood withdrawn. The injection of the salt solution must be stopped immediately symptoms indicative of a rapid rise of intravascular pressure are observed.

After an interval of five to six hours the animal is bled to death.

The liquid obtained at the second bleeding has exactly the appearance of blood, but of course it differs from blood in several physical characters.

Eighty-five calves yielded from 3·4 to 4·6 litres of blood at the first bleeding, and from 3·5 to 5·5 at the second bleeding.

Parallel experiments, in which animals were hyperimmunised with pure blood and with washings from the vessels, showed that the sera obtained from the two batches were identical in respect of their protective properties.

The conclusions drawn are as follows :—

In the production of anti-rinderpest serum it is desirable to increase the quantity of virus available in order to have a larger amount of antigen for the production of the serum, and thus lessen the expense of obtaining susceptible animals.

The method of diluting the virus suggested by HOLMES and BALDREY does not appear to be justified, inasmuch as the serum produced by the diluted virus is less active than that produced by the pure virus.

The method of washing out the peritoneum first suggested by NICOLLE and ADIL Bey yielded, after the liquid used had been modified, better results. But the fact remains that the serum produced in this way was always rather less active than that produced by pure blood, and the technique is likely to lead to accidents.

The use of the liquid obtained by washing out the blood vessels is quite satisfactory, because (a) the yield of virus is increased by 70 per cent., (b) by its use as antigen a serum equal in activity to that produced by pure blood was obtained, and (c) the technique of the method is easy and absolute asepsis is maintained.

(253). THEILER (A.). *Historical Sketch of the Investigations into Lamziekte.—Report of Dept. of Agric. Union of S. Africa. 1913-1914.* pp. 123-129.

HUTCHIEON's inquiries into the nature of this disease in 1895 led him to form the opinion that it was due in some way to a deficiency of phosphates in the diet. An experiment designed to test this view certainly gave it considerable support.

A further carefully controlled series of experiments carried out in 1907 lent additional support to this view. In both these sets of experiments the administration of bone meal appeared to have a remarkable effect in preventing the disease.

Two years later another experiment on the same lines also furnished confirmatory evidence that the view put forward was correct, but in this case so much reliance could not be placed upon the experimental results, as it was shown that some of the animals died from a disease other than lamziekte, namely heart water.

Between 1904 and 1910 three or four reports were published regarding the pathology of the disease, in which support was given to the view that the cause of the condition was an organism of the fowl cholera type.

An experiment carried out in 1908 by the Government Veterinary Bacteriologist for the Transvaal yielded negative results, as none of the animals died, but during the course of these experiments the fact was established that stijfziekte and lamziekte, regarding the identity of which there had been some doubt, were in reality two different conditions and, further, that the former of these was due to the cattle eating *Crotalaria burkeana*.

In 1909 a further series of experiments was carried out, but again the results were inconclusive as only one control animal died.

Experiments were again undertaken in 1911. Fifty animals were allowed to graze night and day upon the veldt, and fifty others were herded with them, but these were muzzled during the day and fed in a kraal at night with forage from a clean area. Of those at liberty on the veldt 28 per cent. became affected and only four animals recovered.

All attempts to transmit the disease with materials derived from dead animals failed.

No cases of lamziekte were produced in experiments in which animals were fed with 57 species of plants.

Grass cut from the land where the grazing cattle had contracted the disease failed to produce any cases when fed to cattle in clean areas. It was further found that the disease tends to disappear when an infected area has been well grazed down.

Experiments to test the view that the disease might be due to lack of vitamines failed to produce any evidence to this effect.

It was found that a certain degree of immunity was established by the inoculation of susceptible animals with blood derived from cases of the disease and also with cultures of the organism of the fowl cholera type which had been blamed as the cause of the disease. This immunity, however, did not appear to be specific.

The general conclusions arrived at are as follows:—

The disease is primarily one of the muscular system, the nervous system being involved secondarily. The toxin which is responsible for the disease of the muscular system is not necessarily cumulative in action, as cases may occur in as short a period as fifteen days after exposure. The toxin is in some way connected with the feeding of grass, but whether the grass as such or something taken in with the grass is responsible cannot yet be determined. The failure to set up the disease with grass or hay from a lamziekte area tends to support the latter view. The fact that in one of the experiments in which the animals were muzzled two contracted the disease ten and twelve days after they had ceased grazing may possibly indicate a period of incubation.

- (254) WATSON (E. A.). *Swamp Fever Research.—Report of the Veterinary Director General, Canada, for the Year ending March 31, 1914.* Appendix No. 19, p. 116.

Owing to pressure of work in carrying out diagnoses of dourine the investigation of swamp fever has not been prosecuted as fully as it might otherwise have been. It has, however, been found that infected animals may appear to be in perfect health, and that horses which have survived may carry the infection for periods of a year or even more.

Animals other than the horse appear to show no evidence of infection when inoculated with virulent materials.

There is a prospect that it may be possible to devise a method of diagnosis based upon the precipitin reaction.

- (255) WYSSMANN (E.). *Zur perniziösen Anämie der Pferde. [Pernicious Anaemia in the Horse.]—Schweiz. Archiv. f. Tierheilk.* 1915. Sept. Vol. 57. No. 9. pp. 427-449.

In the introductory portion of this paper the author summarises the literature regarding pernicious equine anaemia, and draws attention to the theory of causation published by the SEYDERHELMs in the *Berliner Tierärztliche Wochenschrift* for 1914, that the condition is due to a toxin elaborated by *Gastrophilus equi* and *Oestruus haemorrhoidalis*.

Wyssmann has seen 125 cases of anaemia in horses, of which 44 were of a pernicious character. In the remaining cases the anaemia was a secondary condition.

Although the author has seen cases of the disease in good stables, the majority occurred in dark, damp stables.

In fifty per cent. of cases the animals were under seven years old.

The majority of cases occurred during the months March, May, August, September, October, and November.

In most cases the onset of the disease is sudden, with an elevation of temperature. There is marked depression and the animals have a sleepy appearance. The visible mucous membranes have a pale red tint which is sometimes slightly yellowish.

The pulse is weak and accelerated, ranging from 50 to 90 per minute, and this is associated with rapid breathing and complete loss of appetite.

In cases of longer standing there is oedema of dependent parts, the mucous membranes are pale or even yellow. In the majority of the acute cases observed by the author the animals affected were in good condition at the time when the disease made its appearance.

In acute cases the haemoglobin content of the blood is between 30 and 50 per cent., and in cases that are of longer standing it may be as low as 15 per cent. The yellow opalescent appearance of the blood serum is particularly striking.

Although the author does not appear to have made any blood counts, he judges by examining blood in a test tube that there was no decrease in the number of red corpuscles in acute cases.

The lesions are in general of a dropsical type. The liver is enlarged and firmer in consistence than normal, as a result of degeneration of the parenchyma. The spleen is generally enlarged and the surface may show a number of haemorrhages as large as nuts. The kidneys are enlarged and pale in colour. The serous membrane of the large intestine frequently shows ecchymoses, and the haemorrhagic swelling of the lymphatic glands is very pronounced.

In the author's opinion the prognosis is not so unfavourable as many observers think. Of his 44 cases, 25 died, 5 improved, 11 were cured, and of three he lost sight. He thinks there is a chance of improvement while the haemoglobin content does not fall below 40 to 55 per cent.

In a tabular statement the author gives the records of the 44 acute cases, showing the range of temperature, pulse, respirations, symptoms, percentage haemoglobin-content of the blood, ratio of red blood corpuscles to the plasma, duration of the treatment, and the result.

He recommends the subcutaneous injection of a ten per cent. watery solution of atoxyl, but in advanced cases accompanied by oedema this drug does not give good results. In acute cases at least one dose should be given a week, and the quantity should be from 10 to 20 cc.

(256) BURGESS (E.). Disease in Swine.—*MS. Report by the Acting Director, Bacteriological Institute, Colombo, to the Senior Sanitary Officer.* 4 pp. f'cap. Dated April 5th 1915.

This report contains a brief description of an organism isolated from the organs of two dead pigs and one killed for the purpose of the examination. No information is given regarding the nature of the disease in the pigs.

No organisms of the haemorrhagic septicaemia type nor *B. suiseppticus* could be detected in any of the viscera.

The organism isolated was a non-motile, Gram negative diplococcus (or possibly a diplococcus) measuring about 0·5 microns by 0·4. On agar, gelatin, and serum a thin whitish or transparent growth was developed. There was no liquefaction of the latter two media. In broth a slight turbidity was produced, but there was no pellicle formation. There was a slight formation of indol, and possibly some reduction of nitrates. Neutral red was not reduced.

In media containing saccharose, mannite, glucose, maltose, dextrin, sorbite, galactose, laevulose, and glycerin a slight degree of acidity was produced, but there was no gas formation.

No change was produced in lactose, dulcite, raffinose, arabinose, adonit, inulin, inosit, salicin, amygdalin, isodulcite, erythrone, or litmus milk.

The organism was obtained in pure culture or almost pure culture from the spleen of each of the pigs and in one of them also from the liver, lungs, and a gland.

Guinea-pigs inoculated intraperitoneally with 18- or 24-hour broth cultures generally died within 24 hours. The organism was recovered from some of these and used for the inoculation of a further series, in which the same results were obtained.

The post-mortem appearances presented by the guinea-pigs were : Marked subcutaneous congestion, the tissues having a purplish-pink colour. Congestion of the peritoneum and small intestine. Very marked congestion of the inguinal glands. Excessive quantity of fluid in the peritoneal cavity. Liver, lungs, kidneys and spleen apparently normal.

The symptoms prior to death were : The animals were very weak and only able to move with difficulty, and just before death they lay quite motionless. There was no diarrhoea.

The symptoms and lesions observed in naturally infected pigs are stated in a marginal note to be practically identical with those observed in the experimentally infected guinea-pigs.

Blood from the live pig, and from two of the infected guinea-pigs failed to give positive results when the agglutinating power of the serum was tested with the organism.

(257) COCA (A. F.). A Rapid and Efficient Method of producing Haemolytic Amboceptor against Sheep Corpuscles.—*Jl. Infect. Dis.* 1915. Sept. Vol. 17. No. 2. pp. 361-368.

The author states that the usual method of producing haemolytic serum, by giving a series of injections at intervals ranging from a few days to a week, frequently fails to produce a serum which is both of high haemolytic strength and good in its lasting qualities. He finds that intravenous injections of small quantities of corpuscles at short intervals produce highly haemolytic sera which retain their power with great constancy. The most powerful sera obtained were yielded by animals (rabbits) which had daily intravenous injections of washed sheep corpuscles of 0·1 cc. for many weeks.

Comparative experiments carried out with rabbits indicated that stability of haemolytic strength was obtained better when the animals received only a few injections than when many were given. It was found that two injections of 1 cc. of corpuscles at an interval of five

days produced sera of a power equal to those obtained when the dose of corpuscles was 2 cc. with second injections of 5 or 10 cc.

In comparative tests the evidence obtained indicated that the optimal time for giving the second injection is not earlier than the fourth day after the first. The maximum content of haemolysin is reached after a first injection in about seven days, and it is not more than five days after the second.

Sera prepared in the manner described and preserved on ice after the addition of 0·25 per cent. of carbolic acid retain the same degree of haemolytic power for two months.

(258) COOPER (W. F.) & LAWS (H. E.). *Some Observations on the Theory and Practice of Dipping.—Parasitology.* 1915. Sept. Vol. 8. No. 2. pp. 190–217. With 1 plate & 2 text-figs.

In the introductory portion of this paper a brief general survey of the subject of dipping, and a description of the tank and its method of use are given.

It is pointed out that the concentration of the dip should be varied according to the interval between successive dips and the species of tick to be killed. The South African ticks may be divided into three classes. The one which is most easily killed is the Blue tick. The Bont tick and the Bont-legged tick (*Amblyomma hebraeum* and *Hyalomma aegyptium*) are the most difficult to kill. The Brown tick (*R. appendiculatus*) has so short a life-cycle that dipping must be repeated at frequent intervals.

It has been found that the addition of an emulsion to a dip allows the proportion of arsenic present to be reduced without rendering the dip less effective, and this also prevents undue interference with the work of the animals dipped. It is pointed out that sheep should be dipped in a special tank, as if they are passed through a tank that is used for cattle some of the hair shed by the latter gets into the wool and causes trouble in working it.

With regard to the manner in which the arsenic gains access to the tissues of the tick, the authors state that experimental inquiry tends to prove that it is imbibed and is not absorbed through the integument.

The explanation offered for the increased effectiveness of a dip containing an emulsion (soap, glue and oil, etc.) is that it has a far greater wetting power, and consequently the proboscis of the tick becomes actually wetted where it penetrates the skin.

An outline is given of experiments that were carried out to determine whether the arsenic is taken by the tick from the skin or from the blood, and the conclusion drawn is that the evidence tends to prove that it is from the skin and not from the blood.

There is also evidence to show that by repeated dipping an animal does accumulate arsenic in its skin up to a certain maximum, the excess being absorbed by the blood vessels and subsequently excreted.

A calculation shows that the quantity of arsenic remaining on the skin after a single dipping is about 30 grammes, i.e., a full toxic dose if administered by the mouth. In the short interval dipping system this amount may be applied to the skin of an animal at intervals of a few days for a period of years without producing any symptoms of poisoning.

In view of these facts it appears to be certain that the blood in the superficial capillaries must contain a considerable proportion of arsenic, although this is of course rapidly decreased by dilution with the blood in the general circulation. Since in such diseases as East Coast fever the organism is injected by the tick into the superficial capillaries there is probably sufficient arsenic there to kill them. This view appears to be borne out in practice. Animals that are regularly dipped could run on infected pasture without contracting the infection.

Reference is frequently made in this paper to the work done by WATKINS-PITCHFORD who investigated the same subjects, and many of whose results the present authors confirm.

Experiments are now being carried out in the Congo by Cooper in connection with the effects of dipping upon trypanosomiasis; dipping affording a means of administering arsenic in considerable doses without risk of poisoning. It is suggested that, in view of the conclusions arrived at as to the means by which ticks acquire the arsenic from dipped animals and the cumulative action of it in the skin, tsetse flies might also be killed in exactly the same manner as ticks. It would appear that dipping might act both as a curative and as a prophylactic measure.

In a number of appendices details are given of many of the experiments performed, and the objections that have been raised to the use of an emulsion in conjunction with the arsenic are criticised.

REPORTS.

- (259) EGYPT. Ministry of Agriculture. Annual Report of the Veterinary Service for the Year 1914. [LITTLEWOOD (W.), Director, Veterinary Service].—49 pp. 1915. Cairo : Govt. Press. [Price P.T.5.]

In addition to the report regarding the contagious diseases this publication contains also those of the Veterinary Pathological Laboratory and the School of Veterinary Medicine.

Section I. Contagious Diseases.—

Cattle Plague. This disease was responsible for 1,348 deaths during the year, including 166 following double inoculation in outbreaks. The death-rate from natural infection was 0·11 per cent. as against 0·14 per cent. for the previous year. Nearly all the outbreaks were dealt with by double inoculation with serum and virulent blood, but in some cases virulent nasal discharge was used. The total number of cattle inoculated was 290,726, and the total number of deaths was 4,215, but of these 3,419 were due to diseases other than cattle plague.

Six hundred and eighty-one animals, which had been immunised in June and July 1912, were tested with virulent blood and no cases of the disease occurred. A further batch of animals immunised two and a half years previously were inoculated with virulent blood and equally good results were obtained.

Rabies. During the year 58 cases were reported. Of these 53 were in dogs, 1 in a cat, 3 in wolves, and 1 in a cow. It is said that the disease is now firmly established in the country, and that owing to the large number of uncontrolled dogs its suppression will be almost impossible.

Glanders. 41 cases were detected as against 66 during the previous year.

Epizootic lymphangitis. 27 cases were reported as against 20 for the preceding year.

Anthrax. There is a large decrease in the number of deaths from anthrax reported, the figures being 224 as against 544 for 1913.

Sheep Pox. The number of cases for 1914 and 1913 were respectively 270 and 132.

Foot and Mouth Disease. There were 254 outbreaks and 3,701 cases. It is said that the disease undoubtedly existed in many localities other than those from which it was reported. The mortality was very low, and as a rule the cultivation of the land was not hindered. A tabular statement gives the available figures regarding the occurrence of the disease in the various European countries during the same period.

Haemorrhagic Septicaemia. Eighty-four cases of this disease were reported, and warning was issued as to the danger of permitting animals to drink stagnant water.

Nine cases of *Spirochaetosis* were reported as occurring in fowls.

Trypanosomiasis. There were reported 28 cases in camels, one in a horse, and seven in Sudanese cattle.

Filariasis was detected in two camels and in one horse.

Piroplasmosis in Egyptian Cattle. During the year, 1,856 cases were reported. Many of these followed the double inoculation. 1,445 animals died.

Between 50 and 60 cases of piroplasmosis have been discovered in Sudanese cattle and sheep. These diseases are dealt with at some length in the Report of the Pathologist.

Contagious Bovine Pleuro-pneumonia. The Sudan Government reported 3,053 cases. Seventy-five cases were detected in Egypt, all of which had apparently been imported from the Sudan.

Section 2. Report of the Pathological Laboratory.—

Piroplasmosis in Sudanese cattle.—

During the year thirty-nine cases of this disease, which has the characters of East Coast fever, were discovered.

The disease is usually a subacute one. The lesions are: Oedema of the lungs, with in some cases infarcts and haemorrhagic spots on the pleura. The spleen is usually moderately enlarged and somewhat softened. The lymphatic glands are enlarged and oedematous. The liver sometimes contains infarcts and is congested. The abomasum contains numerous haemorrhagic spots and crater-like ulcerations. The intestine, especially the small intestine and the caecum, shows some degree of inflammation. The kidneys show infarcts.

In the blood of animals which succumb large numbers of small piroplasms are found, the majority of which were rod-shaped. Blue bodies are found in the spleen, glands, infarcts in the kidneys, in the ulcerations in the abomasum, and in the lesions generally.

East Coast fever has not yet been detected in Egyptian cattle although it has been looked for for several years. Inoculation of Egyptian cattle with blood from Sudanese cattle failed to set up infection, and experiments are being carried out to test the infectivity of gland material containing blue bodies.

No cases developed in animals after a period of three weeks' quarantine.

While the disease closely resembles East Coast fever the author hesitates to class it definitely as that disease, in view of the fact that bodies indistinguishable from Koch's blue bodies have been found in cattle and in sheep suffering from diseases that are certainly distinguishable from East Coast fever.

Piroplasmosis in Sudanese sheep.—

Two cases of a form of piroplasmosis hitherto undescribed have been encountered in sheep among quarantined animals at Cairo. Blood films showed a moderately heavy infection with parasites smaller than those of East Coast fever. The majority of the parasites were rod-like, but ring forms were found. More than three parasites were never found in a single corpuscle, and in most cases only one was present. The fact that blue bodies were present in the spleen places the organism among the Theileria.

During life the animals showed a high temperature, profuse nasal discharge, and jaundice. They were only observed to be ill on the day preceding death.

At the post-mortem the following lesions were found :

There was marked jaundice. The peritoneal cavity contained some dirty greenish liquid. The liver and spleen were enlarged. The kidneys were enlarged, congested, and contained white infarcts. The lymphatic glands were enlarged and haemorrhagic.

Egyptian Fever. This is a piroplasmosis of Egyptian cattle which differs from East Coast fever and from Texas fever. In most cases the disease would pass unnoticed unless daily temperatures were taken and blood examinations made during the periods of fever. It is said that if these steps are taken with almost any batch of apparently healthy cattle cases of infection will be detected.

The parasites discovered during the febrile periods are small piroplasms, the majority of which are ring-shaped. Rod and pear-shaped forms may also be found. In these cases the parasites are extremely scanty in the blood ; only two or three may be found in a whole blood film. Repeated examinations of material taken from the enlarged superficial glands during the febrile periods have failed to reveal the presence of blue bodies. Recrudescences of fever associated with the presence of the parasite in the blood may occur from time to time.

More severe attacks of the disease have been seen which closely resemble Texas fever clinically save for the absence of haemoglobinuria. These attacks generally last for about four days.

The lesions found in cases of this disease are : Linear and pin-head ulcerations in the abomasum. Spleen normal save possibly for a few haemorrhagic spots. Oedema and congestion of the lymphatic glands in general.

This disease is likely to make its appearance in from six to twelve days after a double inoculation against rinderpest. It has often been observed that the febrile attack produced under these conditions is interrupted after a day or two by an interval of two or three days when the temperature returns to the normal.

Trypanblue and arrhenal are apparently entirely without any effect upon Egyptian fever.

Occasionally a fatal case occurs. In these 80 to 90 per cent. of the corpuscles may contain parasites, and four or five may be present in each. In these cases haemoglobinuria has been observed. The spleen is sometimes enlarged, and the kidneys contain numerous minute infarcts. Blue bodies have never been found in any of the lesions.

The transmitting tick is *Margaropus annulatus*.

Coccidiosis has been found in both sheep and goats, and it is said that the diseases are reciprocally transmissible by feeding with sporulating oocysts, but that the parasite obtained from sheep is incapable of infecting fowls. A negative result was also obtained in an experiment in which a monkey and a bull were fed.

Filariasis in the horse. Although *Filaria equina* has long been known to be commonly present in the peritoneal cavity of equidae without giving rise to any symptoms, cases are occasionally seen in which embryos (*Filaria sanguinis equi*) are present in the circulation and which are characterised by the presence of petechiae on the mucous membranes that are yellowish in colour, anaemia, and wasting.

Verminous aneurism of the aorta in cattle.—

This condition has been observed in large numbers of Egyptian cattle, and less frequently in buffaloes. The causal parasite has been identified as *Onchocerca armillata*.

In cases where the lesions are least marked the tunica intima shows a few slightly raised tortuous lines of a yellowish colour about 5 centimetres in length. The worms in such lesions are often partly calcified. Embryos are frequently found in the canal with the adult and in the adjacent connective tissue.

At a later stage there are nodules about the size of peas projecting into the lumen of the invaded vessels.

In advanced cases the whole of the aorta may show tortuous elevated lines, nodules and roughened areas due to the presence of plates of calcareous material. There may also be aneurism.

(260) SOUTHERN RHODESIA. Report of the Veterinary Bacteriologist, for the Year 1914. [BEVAN (Lt. E. W.), Veterinary Bacteriologist.] 5 pp. f cap.

East Coast Fever.—The number of preparations examined was less than in previous years, probably owing to the introduction of systematic dipping.

The Plasmoses continue to be responsible for enormous losses. Until systematic dipping becomes universal certain disadvantages attach to its employment, for example, the limitation of movement of cattle born upon clean areas, as these readily contract redwater when transferred to infested veldt. While redwater readily yields to regular dipping, anaplasmosis is not so easily eliminated. In one instance blood from a nine-months-old heifer, born and running since birth on an area where five-day dipping has been practised for five years under Government supervision, gave rise to fatal anaplasmosis when inoculated into an animal newly arrived from Great Britain.

Experiments to discover a drug which could be used successfully against the disease yielded entirely negative results. A search for a strain of the virus which would provoke mild reactions was successful,

and vaccinated animals are being exposed to natural infection. It is pointed out that the mild course of the disease which is produced experimentally is to a large extent dependent upon the animals being kept under good hygienic conditions.

Trypanosomiasis. During recent years *G. morsitans* has increased in numbers and has acquired a wider distribution. It has shown a tendency to re-establish itself in areas from which it disappeared at the time of the great rinderpest scourge. Recently the trypanosome discovered in 1913, and indistinguishable from *T. brucei v. rhodesiense* of Northern Rhodesia, has been found to have a much wider distribution than was at first recognised, and there is a serious risk that, with the extension of the fly, it may become a source of very grave danger.

Considerable success followed the treatment of animals for trypanosomiasis, but it would appear that in the greater number of animals the trypanosome is not actually destroyed, and that reduction of vitality of the animal from any cause may lead to the infection getting the upper hand again.

Contagious abortion. Experiments have shown that contagious abortion in cattle in Great Britain, British East Africa, Union of South Africa, and Rhodesia are all due to the same organism. It would appear that the disease originated from a Devon bull which was introduced about five years ago. The results produced in the herd into which this animal was brought were so disastrous that the owner sold up his stock and farm. This led to the dissemination of the disease. It would seem, however, that outbreaks at the present time are less serious than formerly. Factors which tend to hinder the spread of the disease are the existence of a well-marked calving period, and the probably rapid destruction of contamination on the land during the dry season. It was found that there was no risk of infecting clean animals by passing them through a dip through which infected animals had been passed, as the dip was rapidly fatal to the causal organism.

Inquiries are being made into the subject of preparing vaccines.

Horse Sickness. No figures regarding the losses are available. The records of horses previously vaccinated are satisfactory. Thirteen of the seventeen vaccinated have been traced. Of these three are known to have died; the remaining ten are still alive although exposed in dangerous districts.

(261) SOUTHERN RHODESIA. Report of the Chief Veterinary Surgeon, for the Year 1914. [SINCLAIR (J. M.), Chief Veterinary Surgeon.] 6 pp. f'cap.

The most important work is that in connection with *African Coast Fever*. There are two points which require solution: the occurrence of a single case in a herd, and the recrudescence of the disease in old centres of infection, in some cases after the lapse of several years.

During the year six outbreaks occurred, but it is doubtful whether these were recrudescences or extensions. The number of animals lost was 199. Although this figure is somewhat higher than that for the previous year, it is seen that progress has been made when the areas involved are taken into consideration.

The value of dipping regularly is well recognised, and the number of tanks now in use is 430.

The centres of infection of *contagious abortion* so far discovered number four. The disease appears to be less virulent than in England, as a smaller number of animals in a herd abort.

Glanders. 681 horses, 231 mules, and 1,743 donkeys were tested with mallein on importation, but no reactions were obtained.

Rinderpest. During the first half of the year the disease had not spread in a southerly direction, and arrangements have been made to prevent its introduction from German territory.

No cases of anthrax, pleuro-pneumonia, black quarter, or rabies have occurred.

Scab in sheep and goats. The prevalence of this disease does not appear to be so great as was supposed, and with the exception of advanced cases in the goat it readily yields to treatment.

Gall-lamziekte. The view previously expressed—that this disease would have made its appearance in Rhodesia long ago if it were capable of being introduced by cattle—was strengthened by a visit to infected areas and by inquiries and investigations regarding the occurrence of the disease there.

With regard to the view recently expressed that it is due to sarcosporidia, it is merely recorded that these parasites have been found in widely separated areas in Southern Rhodesia.

Importation of Cattle from Texas.—

The following summary is extracted from the report of the Chief Veterinary Surgeon :—

1. There is, in his opinion, no disease of cattle in Texas which, with ordinary precautions, is likely to be imported into Rhodesia by the transfer of Texan cattle.
2. Before any general importation is permitted, a small preliminary consignment should be obtained and forwarded to the Veterinary Laboratory, Salisbury, in order (*a*) to carry out certain blood tests, which, after consideration by the Administration on the representation of the Agricultural Union, were considered necessary before cattle from any tropical or semi-tropical country should be generally admitted ; (*b*) to determine what immunity, if any, Texan cattle possess against anaplasmosis (gall-sickness).

3. In importing cattle, certain precautions would have to be observed and certain tests made :—

(*a*). The testing of all animals prior to shipment for tuberculosis and infectious abortion.

(*b*). Inspection immediately prior to shipment by a Federal Veterinary Officer.

(*c*). General health certificate.

(*d*). Special certificate in regard to freedom from scabies.

(*e*). Precautions to be taken that cattle are tick free.

(*f*). Cattle from tick-infested areas only to be imported.

The last point should be insisted on in the owners' interests.

- (262) TRINIDAD AND TOBAGO. Report of the Government Veterinary Surgeon for the Year 1914-15. [MILLER (J. D.)]—4 pp. f'cap. 1915. Port-of-Spain : Govt. Printing Office,

With the exception of anthrax among cattle imported from Venezuela there have been no contagious diseases among imported animals. Venezuelan animals are vaccinated against anthrax before being issued from quarantine. Anthrax regulations are in force against St. Vincent and Demerara.

Quarantine regulations are in force against imported dogs for a period of six months owing to a rather severe outbreak of hydrophobia.

Cattle and swine from the United States are quarantined for a month on account of Texas fever and swine plague (? fever).

- (263) NIGERIA. Annual Report of the Agricultural Department Northern Provinces for 1914. Report of the Veterinary Department. [BRANDT (F. R.)]—Appendix 1. pp. 6-10. Lagos : Govt. Printer.

The following is an abstract of this report as far as it concerns the diseases of animals.

Trypanosomiasis. In every province there are areas where cattle cannot be kept, and the greater part of Kontagora and the districts bordering on the Niger and Benue rivers are danger zones, especially during the wet season.

Pleuro-pneumonia is known throughout the Northern Provinces and small outbreaks are not infrequent. The Fulani have a method of protective inoculation by which a piece of diseased lung is inoculated into the face of susceptible animals. The enormous swelling which results sometimes causes death.

Foot and Mouth Disease is said to occur, and the natives describe a disease which is probably *anthrax*.

Liver fluke is common.

Although ticks of several varieties are found no evidence has so far been obtained of the occurrence of tick-borne diseases, but a thorough examination must be made before any definite information on this point can be obtained.

Trypanosomes of two distinct types have been found in horses. One of these resembles *T. nanum* and was responsible for a fatal termination in every case seen, and the other, which is apparently of the *vivax* type, either is less virulent or produces a more chronic disease.

Although the parasite has not yet been demonstrated it appears to be probable that *epizootic lymphangitis* occurs, and in some parts is the cause of considerable detriment to the horse industry. There is no report of diseases affecting sheep and goats.

- (264) UGANDA PROTECTORATE. Annual Report of the Department of Agriculture for the Year ending March 31, 1915. Veterinary Division. [HUTCHINS (E.), Chief Veterinary Officer.] 1915. Kampala : Uganda Printing and Publishing Co., Ltd.

Rinderpest. The total number of adult animals and calves inoculated by the virulent blood and serum method in the Buganda

Province were 3,058 and 848, and the deaths in the two classes were 196 and 210 respectively. The large number of deaths was mainly accounted for by the fact that the disease had appeared in some of the herds. Serum alone, followed by mixing the animals with those already infected, was found to be an unsatisfactory method.

In 41 cases permanganate of potash was used for the treatment of the disease in the early stages. Only 20 per cent. of the animals died. The mortality in untreated cases is over 70 per cent.

Difficulties have been encountered through the spread of the disease by game, and experience has shown that quarantine methods, though checking the formation of new centres if rigidly enforced, are useless for the stamping out of the disease.

Lack of sufficient staff has prevented the disease from being fully controlled in the Eastern Province. In the Northern Province the disease has not been so severe as formerly, and it has not yet made its appearance in the Western Province.

Foot and mouth disease has been very prevalent among the Mbarara herds, but the economic loss is not serious except in transport animals.

East Coast Fever. This disease has not come much under notice except in calves.

Horse sickness has been found in large numbers of imported mules.

Scabies has been responsible for considerable losses among goats, and *contagious pleuro-pneumonia* is very wide spread in the same species.

Canine piroplasmosis is very common, but generally yields to treatment with trypanblue.

(RICHARDSON U.F.). An outbreak of trypanosomiasis due to *T. pecorum* occurred in September 1914. The herd from which these animals came was examined and infected animals were isolated. Subsequently numbers of animals in different ownerships were found to be infected and *T. vivax* was found. In all about 150 animals died.

It was at first thought that *G. palpalis* was responsible for the transmission, and subsequently when *T. vivax* was found the view was taken that tsetse must be held responsible. Search failed to reveal their presence.

"The course of the disease resembled that described when mechanical transmission by the agency of Tabanidae, and possibly Stomoxys, was the method of infection. That is, although all the cattle were treated in much the same way and grazed on the same ground, they were not uniformly affected."

A number of different drugs were tried for the treatment of infected animals, but none was successful in effecting a cure, though orpiment in ball or as an electuary yielded the best results. The dose was 8 to 12 grammes.

(265) NYASALAND PROTECTORATE. Annual Report of the Department of Agriculture for the Year ending March 31, 1915. Veterinary Division. [GARDEN (G.), Senior Veterinary Officer.]—pp. 29–32. 1915. Zomba : Govt. Printer. [Price 6d.]

Rinderpest has not occurred in the Protectorate. On the outbreak of war the herds were moved away from the border and there is a cattle free belt from nine to fifteen miles wide.

Trypanosomiasis. An outbreak of trypanosomiasis occurred in the Fort Johnston District and resulted in the death of a large number of animals. In tracing the transmitting agent, it was interesting and important to discover that two fly areas formerly divided by the river had become united as a result of the reduction in width of the river from 120 to 50 yards and the disappearance of the current.

A preliminary survey in the Northern District appears to indicate that the fly areas are increasing.

Owing to the absence of many owners on active service and the necessary employment of the veterinary officers on other work, demodicetic mange has made progress. Eradication of the disease cannot be taken in hand until slaughter of affected and in-contact animals, coupled with regular dipping, is possible.

East Coast Fever. The work of investigating the distribution of this disease had to be suspended.

There have been no serious outbreaks of disease due to *Anaplasma marginale* or *Piroplasma mutans*.

Regular spraying has accounted for a diminution in the number of cases and also a marked decrease in the number of ticks.

BOOK REVIEW.

- (266) HOBDAY (Frederick) (T. G.) [F.R.C.V.S., F.R.S.E.] *Anaesthesia and Narcosis of Animals and Birds.*—xi + 86 pp. With 24 figs. 1915. London: Baillière, Tindall & Cox. [Price 5s. net.]

This small work bears a pretentious title which is hardly justified by the contents. Much more attention is given to anaesthesia of the horse and dog than to that of the other domestic animals, and very little to that of birds.

The aim of the book is distinctly commendable, though in places the performance is meagre or unsatisfactory. A somewhat apologetic preface bewails the slow progress of anaesthesia in veterinary surgery, a reproach which is amended in the first chapter by the welcome admission that "anaesthetics are now almost universally employed, at all events in the British Isles, for all major operations" on the horse. The ox, sheep, and pig, as subjects of anaesthesia, do not bulk largely in any veterinary practice, though not for the want, as the author states, of a safe and convenient narcotic or anaesthetic, but mainly for the reason that operations on these animals are restricted to small economical efforts by the surgeon, who can hardly be blamed for not resorting more frequently to anaesthetics when operating on the animals of the farm.

Both general and local anaesthetics are discussed, and the usual methods of administration are fully described, but more information might have been given concerning the effects of narcotics and anaesthetics, not only on the horse but also on the other domestic animals. Intraspinal anaesthesia, which is never likely to meet with more than a very limited employment in veterinary practice, receives adequate attention in a long illustrated abstract of a thesis on the subject by a French veterinarian, M. MENNERAT. More than one fourth of the book is devoted to cocaine and other local anaesthetics, including ethyl chloride and the rarely used ether spray. A curious explanation of the action of narcotics (chloral hydrate, morphia, and scopolamine—the "twilight dream" of parturient women) appears on page 74:—"There are certain agents which do not always absolutely abolish pain to such a complete extent that they can be termed 'true

anaesthetics,' but they have such a numbing effect upon the senses of animals that operations can be performed upon them without evidence of any great pain. . . ."

But no fault will be found with the author's conclusion regarding the value of morphia in canine practice :—"As a narcotic [morphia] acts so well in the dog, and is so safe to administer, that its use has almost superseded chloroform even for very severe operations."

The eleven chapters of the book are very unequal in merit ; two or three are excellent, but several betray haste or uncertain knowledge. Important points are sometimes dismissed in a few lines, barren of instruction. Here and there the information is scrappy, frequently exciting but seldom sustaining the interest of the reader. It is difficult to discover any useful purpose in some passages, for example :—"The horse, dog, and pig have each one stomach ; the ox, sheep, and goat each have four ; the camel has three, and some of these are intractable and very bulky animals, and have to be operated upon in all kinds of improvised situations where they cannot be placed gently on neat operating tables, as with human patients, nor will they remain quiet and refrain from struggling at the mere request of the doctors and nurses." Verbiage of this sort can only be regarded as poor fodder for veterinary students who may be bent on becoming experts in anaesthesia.

The method recommended to terminate the life of the next-to-human dog may be quoted :—"The preliminary use of morphia hypodermically is most excellent when it is necessary to destroy a dog, this being followed up by chloroform inhalation in about twenty or thirty minutes, and finally a dose of Scheele's hydrocyanic acid into the chest when the chloroform has produced unconsciousness." Poor dog ! These are war times, but surely the dog-owner not bereft of humaneness would not care to witness this tedious process of "painless destruction."

The proof-reader of this book cannot be congratulated on his vigilance or accuracy, but the publishers deserve commendation.

J. Macqueen.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 3, No. 3, pp. 115-116.]**Babesiasis.**

- (267) CARPANO (M.) La febbre della costa mediterranea. Piroplasmosi tipo "parvum" nei bovini del basso bacino del mediterraneo. [Mediterranean Coast Fever. Piroplasmosis of the Parvum Type in Cattle on the Southern Coast of the Mediterranean.]—*Ann. d'Igiene Sperimentale*, 1915. Vol. 25. No. 4, pp. 343-410. With 2 plates and 12 text-figs.

Leishmaniasis.

- (268) KOKORIS (D.). Ueber die Splenecktomie bei Kala-Azar. [Splenectomy in Kala-Azar.]—*München. Med. Woch.*, 1915. July 27. Vol. 62. No. 30, pp. 1008-1009.

Malaria.

- (269) ZIEMANN (H.). Ueber eigenartige Malaria-parasitenformen. [Peculiar Forms of Malaria Parasites.]—*Centralbl. f. Bakteriol., 1. Abt. Orig.*, 1915. July 10. Vol. 76. No. 5, pp. 384-391. With 1 coloured plate comprising 45 figs.

Rabies.

- (270) CORNWALL (J. W.) & IYER (S. R.). Arneth's Index and Anti-Rabic Treatment.—*Indian Jl. Med. Res.*, 1915. July. Vol. 3. No. 1, pp. 132-134.

Trypanosomiasis.

- (271) van den BRANDEN. Le sel sodique du Salvarsan cuprique dans le traitement de la Trypanose humaine, du Pian et de la Syphilis. [The Soda Salt of Copper Salvarsan in the Treatment of Human Trypanosomiasis, Pian, and Syphilis.]—*Bull. Soc. Path. Exot.*, 1915. Oct. Vol. 8. No. 8, pp. 582-586.

- (272) FRANÇA (C.). Le trypanosoma inopinatum. [Trypanosoma inopinatum.]—*Arch. f. Protistenk.*, 1915. Oct. 8. Vol. 36. No. 1, pp. 1-12. With 1 coloured plate comprising 17 figs.

Biting Flies and Ticks.

- (273) AWATI (P. R.). Studies in Flies. 1. Chaetotaxy and Pilotaxy of Muscidae and Range of their Variability in the same Species.—*Indian Jl. Med. Res.*, 1915. Vol. 3. No. 1, pp. 135-148. With 3 plates and 6 text-figs.

- (274) BÉGUET (M.). Deuxième Campagne contre les Sauterelles (*Stauronotus maroccanus* Thun.) en Algérie, au Moyen du "Coccobacillus acridiorum" d'Hérelle. [Second Campaign against the Locusts in Algeria (*Stauronotus maroccanus* Thun.) by Means of the "Coccobacillus acridiorum" of d'Hérelle.]—*Ann. Inst. Pasteur*, 1915. Oct. Vol. 29. No. 10, pp. 520-536.

- (275) CHRISTOPHERS (S. R.) & KHANZAN CHAND. Notes on Some Anophelines from Arabia and Mesopotamia.—*Indian Jl. Med. Res.*, 1915. July. Vol. 3. No. 1, pp. 180-200. With 2 plates comprising 10 figs.

- (276) DRAKE-BROCKMAN (R. E.). Some Notes on the Bionomics of *Ornithodoros savignyi* in British Somaliland.—*Bull. Entom. Res.*, 1915. Sept. Vol. 6. No. 2, pp. 195-196.

- (277) HIRST (S.). On Some New Acarine Parasites of Rats.—*Bull. Entom. Res.*, 1915. Sept. Vol. 6. No. 2, pp. 183-190. With 8 text-figs.

- (278) KING (H. H.). Preliminary Notes on the Life-History of *Argas brumpti* Neumann.—*Bull. Entom. Res.*, 1915. Sept. Vol. 6. No. 2, pp. 191-193.

- (279) LUDLOW (C. S.). The Synonymy of *Anopheles christophersi*, Theo., and *A. indefinita*, Ludl.—*Bull. Entom. Res.*, 1915. Sept. Vol. 6. No. 2, pp. 155-157.
- (280) RODHAIN (J.) & HOUSSIAU (J.). Dermatite vésiculeuse saisonnière produite par un coléoptère. [A Seasonal Vesicular Dermatitis caused by a Coleopteron.]—*Bull. Soc. Path. Exot.*, 1915. Oct. Vol. 8. No. 8, pp. 587-591. With 1 plate and 1 text-fig.
- (281) RODHAIN (J.) & VILLENEUVE (J.). *Passeromyia*, genre nouveau des Anthomyidae (Dipt.), à larve hématophage parasite des jeunes oiseaux. [*Passeromyia* a New Genus of Anthomyidae (Dipt.) with Hematophagous Larval Parasitic on Young Birds.]—*Bull. Soc. Path. Exot.*, 1915. Oct. Vol. 8. No. 8. pp. 591-593.
- (282) STANTON (A. T.). The Larvae of Malayan Anopheles.—*Bull. Entom. Res.*, 1915. Sept. Vol. 6. No. 2, pp. 159-172. With 15 text-figs.
- (283) STRICKLAND (C.). Note on *Anopheles brevipalpis* Roper, and Description of its Egg and Larva.—*Indian Jl. Med. Res.*, 1915. July. Vol. 3. No. 1, pp. 201-204. With 1 plate comprising 6 figs.

Helminths.

- (284) KOBAYASHI (H.). On the Life-History and Morphology of *Clonorchis sinensis*.—*Centralbl. f. Bakter., 1. Abt. Orig.*, 1915. Jan. 15. Vol. 75. No. 4, pp. 299-318. With 4 plates comprising 38 figs.
- (285) LANE (C.). *Falcaustra falcata*. An Investigation of *Oxysoma falcatum* von Linstow, 1906.—*Indian Jl. Med. Res.*, 1915. July. Vol. 3. No. 1, pp. 109-115. With 2 plates comprising 9 figs.

Miscellaneous.

- (286) GALLI-VALERIO (B.). Notes de parasitologie et de technique parasitologique. [Notes on Parasitology and Parasitological Technique.]—*Centralbl. f. Bakter., 1. Abt. Orig.*, 1914. Aug. 29. Vol. 75. No. 1, pp. 46-53. With 5 text-figs.
- (287) HADWEN (S.). A Study of Haematuria in France and other Countries.—*Report of Veterinary Director General, Canada, for Year ending Mar. 31, 1914*. Appendix No. 21, pp. 119-128.
- (288) RETTERER (Ed.). Des hématicies du chien. [The Blood Corpuscles of the Dog.]—*C.R. Soc. Biol.*, 1915. Oct. 22. Vol. 78. No. 15, pp. 496-500.
- (289) RETTERER (Ed.) & NEUVILLE (H.). Des hématicies de l'éléphant, du chameau, et du lama. [The Blood Corpuscles of the Elephant, Camel, and Llama.]—*C.R. Soc. Biol.*, 1915. Oct. 22. Vol. 78. No. 15, pp. 500-503.
- (290) WHERRY (W. B.). A Plague-like Disease of California Ground Squirrels affecting Man in Ohio.—*Jl. Amer. Med. Assoc.*, 1915. Oct. 30. Vol. 65. No. 18, p. 1549.

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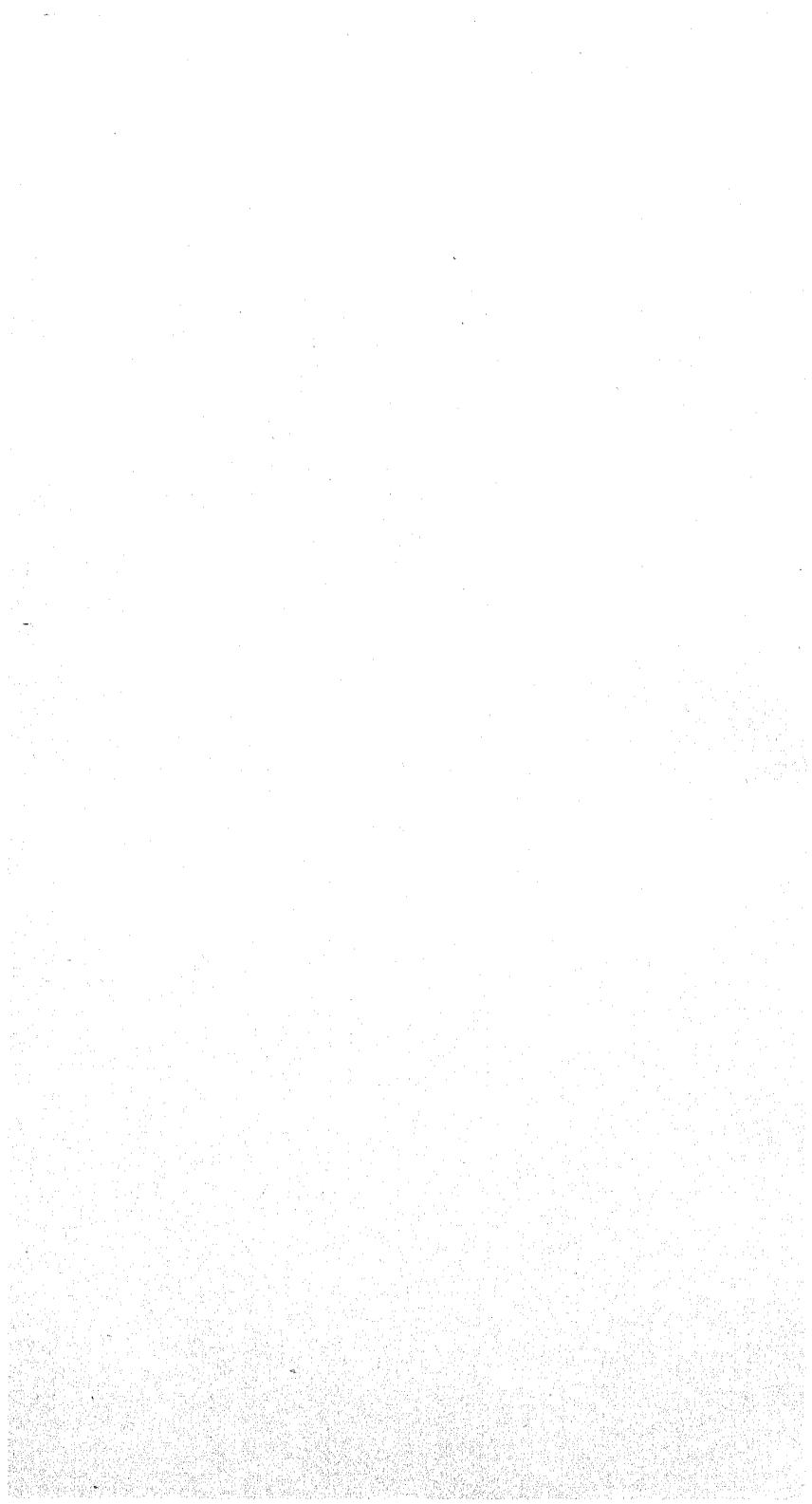
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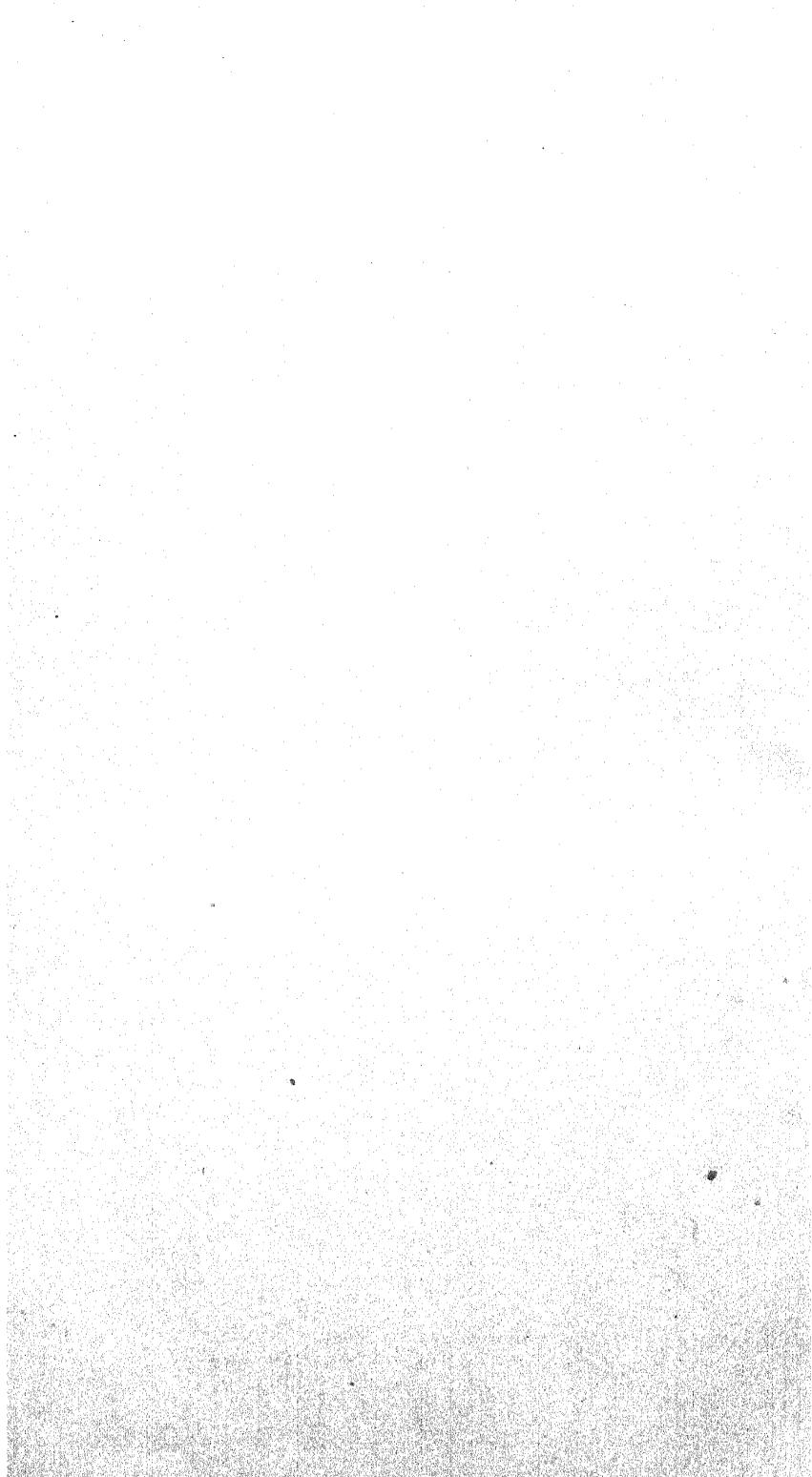
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Erratum.

No. 4, page 150 (tenth line from foot), *for* "especially in the provinces of Cagliari and Sassari," *read* "but more especially in the province of Cagliari than in the province of Sassari."



TROPICAL DISEASES BUREAU.

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[No. 1.

BABESIASIS (PIROPLASMOSIS) AND ANAPLASMOSIS.

- (1) CARPANO (M.). Note epizooziologiche sulle infezioni piroplasmiche degli equini in Italia. [Equine Piroplasmosis in Italy.]—*Il Moderno Zooiatro*. 1915. Oct. 31. Vol. 26. No. 10. pp. 404–412.

Both Nuttalliasis and Babesiasis occur in Italy, but the former is the more common. Occasionally cases of mixed infection are encountered. It would appear that the diseases follow a more benign course in the northern part of the peninsula than in the middle and southern parts, and cases are more frequently seen on low-lying uncultivated land than elsewhere.

According to the author's observations *Nuttallia equi* is transmitted by *Rhipicephalus bursa*, and *Babesia caballi* by *Margaropus annulatus*. The former of these passes the larval and nymphal stages on one host, and transfers itself to another for the adult stage. Ticks may become infected from the first host, and hand on the infection to the second. In the case of *Margaropus annulatus*, on the other hand, all the stages from larva to adult are passed on the same host, and consequently the parasite is handed on to the next animal by ticks hatched out from eggs deposited by an infected female.

Cases of the diseases may arise either as primary attacks or as relapses. The former generally occur during the spring or early summer, but the latter may be observed at all seasons. When a susceptible horse is introduced into an infected area, the period elapsing before the disease makes its appearance is generally 10–20 days. Relapses may occur within a short time after the primary attack, or there may be an interval of some years. They are not as a rule very serious, and seldom terminate fatally.

In apparently recovered animals *Nuttallia equi* persists in the blood for long periods, and should the infected animals become the subject of any debilitating condition a relapse is likely to occur. During the period of latent infection the parasite is said to be present in the blood in a form which resembles *Anaplasma*.

The immunity conferred by an attack or by experimental infection is not an absolute immunity, and it is strictly specific according to the type of parasite responsible for the primary infection.

In the ass and the mule only parasites of the Nuttallia type have been found.

- (2) VELU (H.) & EYRAUD (A.). Observations sur diverses formes de Piroplasmes, rencontrées sur des bovins indigènes de la Chaouia. [The Various Forms of Piroplasms found in Indigenous Cattle at Chaouia.]—*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 643-646.

On a farm about 25 miles from Casablanca one of the authors saw two animals showing the following symptoms : Loss of appetite and suppression of rumination, pronounced thirst, pale mucous membranes, red urine, diarrhoea, the blood pale in colour and watery. There were numbers of ticks in the ears and the perineal region. One animal had already died after showing a similar train of symptoms.

Although piroplasmosis had only been discovered previously in imported animals, the condition of the animals raised the suspicion that they might be affected.

In blood taken from one of the animals a few hours before death 52 per cent. of the blood corpuscles were found to contain parasites. They were present in the form of long and short rods, comma-shaped organisms, oval, rounded, and amoeboid forms. In many cases a number of parasites were present in the same corpuscle, the largest number seen being five. The great majority of the parasites were very small.

In the blood of another animal, which died a few hours later, the number of parasites found was almost the same as in the first case. In two animals shortly after the onset of symptoms, the percentage of corpuscles invaded was about 30, and it was only exceptionally that more than one parasite was found in a single cell.

The small number of observations that the authors were able to make does not warrant any very definite conclusions. They specially point out that twin pear-forms were very scantily present.

- (3) CRAWLEY (H.). Note on the Stage of *Piroplasma bigeminum* which occurs in the Cattle Tick, *Margaropus annulatus*.—*Jl. of Parasitol.* 1915. Dec. Vol. 2. No. 2. pp. 87-92. With 4 text-figs.

The parasite described in this paper was found in some ticks which had been used as controls in some dipping experiments.

They were removed from the cattle, immersed in water, dried, and placed in Petri dishes. Ordinarily such treatment does not cause any unusual behaviour on the part of the tick, but on this occasion a high mortality was observed in certain lots, and microscopic examination of some of them revealed the parasite described in this paper.

The parasites were cigar-shaped, and varied somewhat in length and width. The mean length of 50 specimens taken at random was about 11 microns. The cytoplasm of each was finely alveolar. There was a central vesicular nucleus with a large rounded karyosome. At the more rounded end of the body there was a kind of cap which varied somewhat in appearance in different specimens. In some cases it was rather like a crown with a minute pointed process arising from the central part, and in other cases it was like a narrow shell fitting over the extremity of the parasite. In some specimens the cap appeared to be rather denser and more homogeneous than the rest of the cell.

Analogy is drawn between these parasites and those found by CHRISTOPHERS in *R. sanguineus*, which he considered to be a stage of *P. canis*. Reference is also made to the observations of KOCH, NUTTALL, GRAHAM-SMITH, and MINCHIN regarding the occurrence of similar forms in ticks obtained from animals infected with Piroplasmosis. Whereas some of these authors observed forms other than the club-shaped or cigar-shaped parasites similar to those referred to in this paper, the present author has been able to recognise these forms only.

Parasites of the same kind have been found to be scantily present in eggs from infected ticks, but none have been discovered in crushed seed ticks.

In addition to the gregarinoid parasite a spirochaete was also found. This parasite has not previously been reported in the United States, and it is suggested that it is identical with *S. theileri*.

No experimental evidence was forthcoming that the cigar-shaped parasite was actually a stage of *P. bigeminum*.

- (4) PORTER (Annie). On Anaplasma-like Bodies in the Blood of Vertebrates.—*Ann. Trop. Med. & Parasit.* 1915. Dec. 30. Vol. 9. No. 4. pp. 561-568. With 10 text-figs.

The summary of this short paper is as follows :—

"Anaplasmata may occur in healthy and in anaemic vertebrate blood. The structures, also called marginal points and peripheral coccus-like bodies, are probably of diverse origin. It is doubtful if they are organismal in nature.

"Anaplasmata have been found by me in warm and cold-blooded vertebrates, wherein conditions such as herpetomoniasis and anaemia occurred. Some of the bodies originate from the nucleus of the erythrocyte or erythroblast, under the influence of haemolysis.

"The Anaplasma-like bodies were basophilic, apparently composed of chromatin or of a substance giving a similar staining reaction, and were homogeneous in structure. They varied from $0\cdot3\mu$ to $2\cdot0\mu$ in diameter, often being about $0\cdot5\mu$. Binary and multiple forms, which might be interpreted as phases of division, were seen."

- (5) WILLIAMS (A. J.). Report of the Treatment of Nuttalliosis or Biliary Fever in Army Horses at Secunderabad, Deccan, India.—Army Headquarters, India. Quartermaster General's Branch, Simla, 1914. Calcutta: Superintendent Government Printing. pp. 1-6. With 1 fig. & 8 charts.

The characteristic symptoms of the disease are: Sudden onset, dullness, loss of appetite, yellow to orange discolouration of the mucous membranes, the presence of petechiae which are red at first and subsequently become purple, and often increasing in size and coalescing to form large blotches on the mucous membranes. The initial temperature may be as high as 108° F., and in severe cases there is marked prostration. Remissions occur about every third day, though the temperature never rises so high as at the onset of the disease.

There is rarely observed any haemoglobinuria during the course of an attack, but in a few cases it has been noticed after the lapse of some months.

If the cases are recognised and put under treatment promptly, complications such as acute congestions of the lungs, enteritis, etc., do not occur. Where the disease is known to exist, it is of the utmost importance that any horse showing signs of dullness and loss of appetite should be placed under careful observation and its temperature taken. The rapidity with which an affected horse is placed under treatment is of the greatest importance.

As the evidence in India points to the disease being spread by flies and mosquitoes, isolation must be promptly effected.

When ticks are found in stables they must be traced to their source and their further introduction prevented. They should be eradicated from the stables by the constant use of the blow lamp, as they penetrate into cracks in the walls and ordinary disinfectants, do not reach them.

Treatment:—Quinine sulphate given in two dram doses twice or three times a day together with 4 to 8 ounce doses of magnesium sulphate to regulate the bowels has not been found to be successful. In some cases the disease was controlled for a few days, but remissions generally occurred with considerable loss of condition. Good results were obtained with half-dram quinine acid hydrobromide; remissions generally occurred, but the animals were fit for duty in about a fortnight after the administration of a second dose.

The same drug in one dram doses yielded even better results.

Trypanblue has given excellent results, the temperature falling to normal within three days.

In some cases the action of trypanblue is more marked than that of quinine; this has been noticed in cases where examination of the blood showed no parasites but the presence of marginal dots suggesting anaplasmosis, and in these cases the disease is usually a severe form of biliary fever.

In some cases in which the quinine acid hydrobromide failed to arrest the remissions it was followed by trypanblue with good results.

In two cases which did not improve under treatment with trypanblue this drug was followed by the quinine salt and good results were obtained.

In all these cases magnesium sulphate was given as necessary.

Large doses of arsenic appeared to be entirely without effect upon the parasite.

In cases complicated by congestion of the lungs great relief was afforded by the intravenous injection of one or two pints of normal saline solution after venesection.

During convalescence the animals were given five grains of arsenic and one dram of sulphate of iron in bolus twice daily.

The after-effects of quinine injections.—When quinine acid hydrobromide, or quinine bi-hydrobromate (Howard's), in half to one dram doses in an ounce of water is used, staggering usually occurs immediately after the injection. These symptoms of syncope are most marked in animals with a very high temperature, in cases showing pronounced prostration, and in animals in poor condition. As a rule these symptoms pass off in from 10 to 20 minutes and no further symptoms occur, but cases should be kept under observation as occasionally toxic symptoms

appear a few hours after injection, the respirations are very accelerated, and the pulse very weak. In such cases one grain of strychnine given hypodermically soon gives relief.

It would appear that in some cases the parasites are very small and difficult to stain. It has often been noticed that while the chromatin stains intensely the cytoplasm stains faintly. Some of the larger pear-shaped parasites are granular and show a distinct central vacuole.

It not infrequently happens that parasites cannot be found except with prolonged searching in the early stages, even when the temperature is as high as 105° to 107°. But at the second rise of temperature and in the later stages of the disease they are generally found with ease.

The parasite has been found in cases showing simple oedema with no rise of temperature, and no other symptom of the disease. One attack appears to confer immunity, and up to the time of writing no recurrence had been observed in any animal treated with quinine or trypanblue. The cases were to remain under observation to see whether they would contract the disease again the following year.

No cases have been seen in mules or in country-bred horses, and very few Arabs contract the infection.

In view of the fact that the disease can be transmitted by blood inoculation, it appears to be probable that it may be spread mechanically by biting flies, and the observations made appear to indicate that this is in reality the case.

Although ticks are capable of spreading the disease, in outbreaks at Deesa, Neemuch, Nasirabad, and Ambala no ticks could be found on the horses nor in the stables. The disease appears to be more prevalent during and after the rains.

The following flies and ticks have been found :—

Haematopota have been found in cantonments and near tanks in the vicinity. They attack horses vigorously.

Tabanus rusticus has been seen but not caught. This fly has been observed to bite infected horses.

Hippoboscidae have also been seen.

Hyalomma aegyptium has been found on horses and cattle. Its presence on horses and in stables is accounted for by the proximity of bullock sheds and the storing of bedding in the sheds.

Rhipicephalus has been found on dogs.

The only satisfactory method of eradicating ticks from a stable is the constant and thorough use of the blow lamp.

In his conclusions the author emphasises the necessity of an early diagnosis and prompt treatment. The intravenous injection of quinine acid hydrobromide gives excellent results. The appearance of pronounced symptoms of depression may be cut short by the injection of strychnine. As a rule quinine only produces toxic symptoms in animals with a very high temperature; if there is a slight rise of temperature only, no such symptoms are produced.

For large horses a single dose of one dram is as a rule sufficient. For small horses and ponies half that dose should be given. The dose need not be repeated unless there are persistent remissions of temperature, and the membranes remain icteric.

At the commencement of an outbreak quinine should be tried on some cases and trypanblue on others as the one appears to be more efficient in some cases than the other, possibly owing to some difference in the strain.

In a letter dated January 7th, 1916, accompanying the report, the author states that the yellow quinine acid hydrobromide, which can conveniently be put up in tablet form, is preferable as it is easily soluble.

Since the report was written 300 cases of the disease have been treated in this way with only 11 deaths.

- (6) MACFIE (J. W. Scott). *Babesiosis and Trypanosomiasis at Accra, Gold Coast, West Africa.*—*Ann. Trop. Med. & Parasit.* 1915. Dec. 30. Vol. 9. No. 4. pp. 457-494. With 2 plates & 6 charts.

In a tabular statement the author shows the results of the examination of a single film of blood taken from 100 of each of the following animals at the Accra slaughter-houses:—

TABLE I.—The results of the examination of 500 domestic animals for babesiosis.

Host.	Number examined.	Number infected with piroplasms.	<i>B. bigemina.</i>	<i>T. mutans.</i>
Cattle, humped ..	100	53	7	49
Cattle, straight-backed ..	100	40	3	38
Sheep ..	100	21	—	21
Pigs ..	100	—	—	—
Goats ..	100	—	—	—
Totals ..	500	114	10	108

The humped cattle are for the most part bred in the north and driven down to the markets. The straight-backed cattle are bred in the south. Some of the sheep come from a distance to Accra, but the goats and pigs are probably all bred locally.

The infections appeared to be benign, but as many of the animals were also infected with other parasites, and especially with trypanosomes, no definite conclusion could be arrived at with regard to this point. The blood of the animals showed a variety of abnormalities indicative of anaemia. No experimental investigations could be made as no certainly uninfected animals were available for the purpose.

The following species of ticks were collected from the cattle and sheep:—*Boophilus*, *Amblyomma variegatum*, and *Hyalomma aegyptium*.

The parasite which the author considered to be *B. bigemina* in the humped cattle appeared to be rather smaller than that found in the straight-backed animals, and its chromatin was rather less distinct.

The smaller parasite was generally present in small numbers only, but in a few cases the infection was a heavy one. Examination of preparations from the spleens of a number of infected animals failed to reveal any "blue bodies."

The author quotes MINCHIN with regard to the nomenclature of the genera *Theileria* and *Babesia* and concludes that, to avoid confusion, it is advisable to identify the small pleomorphic parasite as *Theileria (Babesia) mutans*.

Only a single case of canine babesiasis came under the author's notice at Accra, and that was in a dog which had been imported six weeks previously. At the time when the examination of the blood was made parasites were numerously present.

A piroplasm, *Nuttallia decumani*, n. sp., of the brown rat (*Mus decumanus*).—

This parasite was discovered in the blood of four rats. From two of these only a single film was obtained, and in both parasites were rare. Of the other two one was under observation for just over a month, and the other had been under observation for two or three months at the time of writing.

In the first of these animals the piroplasms made their appearance a few days after capture and increased up to the 15th day, by which time a considerable number were present in the blood. They then diminished, and by the 26th day had become very scanty again. They were still present in very small numbers on the 37th day when the rat was accidentally killed.

Parasites were detected in the blood of the other rat on the day of capture and they persisted for ten days.

Both of these rats showed Grahamella in their blood when captured, but these subsequently disappeared.

The majority of the piroplasms were amoeboid or ring-shaped, with an irregular mass of chromatin. In some of them there were two distinct masses of chromatin, and these in some of the ring-forms were placed opposite each other.

In addition to these forms there were found a few which appeared to have undergone division, as there were four lanceolate parasites arranged in the form of a cross. In each of these there were two dots of chromatin.

Subcutaneous inoculations of infected blood into white rats failed to transmit the infection, and a single attempt to infect a brown rat with ticks from an infected animal also failed.

Trypanosomiasis.—Three types of trypanosomes were found, and these the author identifies as *T. pecaudi* (*T. brucei* of Uganda; *T. ugandae*), *T. vivax*, and *T. pecorum* (*T. congolense*). These were found as shown in the following table in the smears used in the examinations for Babesia.

TABLE II.—Trypanosome infections found in animals killed at Accra slaughter-house.

Host.	Number examined.	Number infected with trypanosomes.	Percentages infected with		
			<i>T. vivax.</i>	<i>T. congolense.</i>	<i>T. pecaudi.</i>
Cattle, humped..	100	92	76	28	12
Cattle, straight-backed ..	100	18	14	6	1
Sheep ..	100	4	3	2	—
Pigs ..	100	5	—	5	—
Goats ..	100	1	1	1	—
Totals ..	500	120	18·8	8·4	2·6

As tsetse flies are only found very occasionally in Accra it is probable that the animals are infected before they reach the town. Tsetse flies are quite numerous within a few miles of Accra. The identification of the trypanosomes found was based almost exclusively upon the appearances presented by the parasites in a single preparation from each animal. A few experimental inoculations were made and these are said to have confirmed the diagnoses.

The author gives a number of charts showing the measurements of the parasites found and their percentage distribution.

A single case of trypanosomiasis was found in a dog. In the blood of this animal there were parasites of the *congolense* type, but they were too scanty to permit of any measurements being made. The animal was in an emaciated condition, was covered with sores and had a profuse watery discharge from the eyes. The infection terminated fatally.

The number of cases of equine trypanosomiasis encountered by the author and the types of trypanosomes found are shown in the following table.

TABLE VI.—Equine trypanosomiasis at Accra.

Host.	Cases of trypanosomiasis.	Number infected with		
		<i>T. vivax.</i>	<i>T. congolense.</i>	<i>T. pecaudi.</i>
Horses ..	13	2	4	7
Mules ..	5	—	—	5
Donkeys ..	1	—	1	—
Totals ..	19	2	5	12

In one case in a mare the trypanosome found was of the *congolense* type, but differed from that organism in certain respects.

The disease in this case lasted for two months, and during that time distinct plaques were seen on at least two occasions.

The trypanosome was a rather short stumpy one without free flagellum. The centrosome was generally placed at a little distance from the posterior extremity, while the nucleus was frequently placed quite close to the anterior end. On some days 50 per cent. of the trypanosomes showed this disposition of the nucleus. The body was homogeneous or finely reticulated, and the undulating membrane was very poorly developed. In the final stages of the disease many of the trypanosomes showed a deeply staining chromatin dot posterior to the nucleus.

From a table of the measurements of 300 trypanosomes it may be gathered that the maximum length was 17 microns, and the minimum 8, and that the peak of the curve of distribution occurred at 12. Three white rats, two guinea-pigs, and a rabbit were inoculated, but none of them became infected.

On account of the clinical aspect of the disease the author suggests that the trypanosome should be called *T. congolense* var. *equinum*.

Two cases of trypanosomiasis resembling acute dourine are described at some length. Both animals were mule mares and in both cases a polymorphic trypanosome of the *pecaudi* type was found.

In both cases the onset of the disease was extremely sudden—the animals had been at work in the morning—and in both cases there was depression, slight subcutaneous oedema, commencing paralysis of the hind quarters, and a watery discharge from the eyes and nose on the afternoon. In both cases also plaques about the size of a shilling appeared on the skin on the day following the onset of symptoms. The animals had to be destroyed on the third day of the disease as they were in a hopeless condition.

A single guinea-pig was inoculated from each, but only one became infected. Trypanosomes appeared in the blood on the seventh day and the guinea-pig died on the ninth. The strain was unfortunately lost through the death of the guinea-pig inoculated from the first one after an interval of two days only. The maximum and minimum lengths of the trypanosomes as shown by 25 parasites were 33 and 13 microns.

The author thinks that, though these animals could not have been infected during copulation, it is not impossible that the trypanosome was the same as the polymorphic strain of the dourine parasite which YORKE and BLACKLOCK described as being indistinguishable from *T. rhodesiense* in 1913.

TRYPANOSOMIASIS.

- (7) SERGENT (Ed.), SERGENT (Et.), LHÉRITIER (A.) & BÉGUET (M.).
Comparaison entre le Trypanosoma soudanense et le Trypanosoma berberum. [Comparison between *T. soudanense* and *T. berberum*.]
 —*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 650-653.
 With 1 chart.

In this paper the authors give the details of some experiments designed to test the correctness of the view that they had previously expressed regarding the non-identity of the two parasites.

In 1907 LAVERAN on the ground of cross immunity experiments expressed the view that the two trypanosomes were identical, but in 1912 the authors working with LAVERAN'S strain of *T. soudanense* arrived at the opposite conclusion.

Subsequently LAVERAN again studied the question and reversed the cross-immunity experiments carried out in the first instance, but again came to the conclusion that the two trypanosomes are identical. Further cross immunity experiments by the present authors confirm their previous opinion that the two are distinct.

They therefore hold that the name *T. berberum* for the causal agent of debab should stand.

- (8) VELU (H.). *La Trypanosomiase des chevaux du Maroc. (Étude clinique).* [Equine Trypanosomiasis in Morocco. (Clinical study.)] — *Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 646-650. With 1 chart.

The symptoms presented by horses affected with trypanosomiasis in Morocco are in general those observed in other forms of chronic trypanosomiasis, with the notable exception that oedema is almost invariably absent. The onset of the disease is often unnoticed, but its course is marked by a progressive anaemia which shows at intervals acute phases.

The first symptom usually observed is the rapidity with which an animal becomes fatigued at work. While in the stable the animal is dull, and though the appetite is maintained it is capricious.

As the disease progresses the anaemia becomes more marked and there is increasing wasting and loss of condition. Together with this there is observed an uncertainty of gait, especially involving the hind legs. At this stage attacks of high fever occur. These are generally of short duration and more than two in a month are seldom observed. The temperature will run up three or even four degrees in a few hours. This elevation of temperature is accompanied by acute depression, difficulty of respiration, and acceleration of the pulse. These attacks may last from 12 hours to four or five days. After such an attack the animal returns to its former condition save that the anaemia and general cachexia are more pronounced. These attacks coincide with increases in the number of parasites present in the blood. It is also observed that while during the general course of the disease the visible mucous membranes are white or bluish, during the acute phases they become yellowish.

The disease is not invariably fatal, but when recovery takes place the period of convalescence is very protracted.

It is stated that in some cases there are pronounced symptoms of enteritis and jaundice. Only a relative value attaches to the presence of petechiae on the mucous membranes, as these are not infrequently seen in healthy horses in Morocco. In a few cases slight transient oedema has been observed, together with enlargement of the glands and lesions of an eczematous nature.

The blood is always pale and watery. The muscles are pale and infiltrated with serous liquid. The lymphatic glands are generally

enlarged and reddish in colour, and when an animal dies during an acute febrile attack there is marked enlargement of the spleen. The liver is frequently brownish in colour, and the intestine shows slight congestion.

Purely clinical diagnosis is a matter of some difficulty, but daily examination of the blood, especially when the temperature is elevated, enables one to establish a diagnosis with certainty.

- (9) LAVERAN (A.). L'infection par *Trypanosoma gambiense* chez un maki, un renard, un raton, deux loirs, un meriones et deux gerbillles. [A Lemur, Fox, a Raccoon, Two Dormice, a Merione,* and Two Gerbils infected with *T. gambiense*.]—*Bull. Soc. Path. Exot.* 1915. Dec. Vol. 8. No. 10. pp. 745-751.

In this paper the author gives details of inoculations with *T. gambiense* of animals that are not generally used in laboratories.

Of two lemurs one was inoculated subcutaneously with blood from a guinea-pig infected with *T. gambiense*, and the other with blood of a guinea-pig inoculated with *T. rhodesiense*. The former survived for 26 days, after having passed through a slight crisis about ten days after inoculation. The latter died on the sixteenth day, trypanosomes having been present in the blood in increasing numbers from the fifth day up to the day of death.

The fox survived until the 56th day. During the course of the infection there were several crises, and at the time of death trypanosomes were scantily present in the blood. Opacity of the cornea was first observed on the 32nd day. This however disappeared, again to become visible after an interval of a few days. At the time of death there was complete opacity of the cornea of both eyes, and trypanosomes were present in large numbers in the aqueous humour. Apart from this the only lesion found at the post-mortem was enlargement of the spleen.

In the raccoon the period of incubation was twelve days, and the duration of life 31 days. Prior to the appearance of the trypanosomes in the blood there was marked agglutination of the red corpuscles. There was one crisis during the course of the infection, and at the time of death parasites were scantily present in the blood.

In a dormouse that was inoculated intraperitoneally the period of incubation was three days, and death took place on the seventh day. Another dormouse which was inoculated subcutaneously lived until the 22nd day, the period of incubation having been seven days. In both cases the trypanosomes steadily increased in numbers in the blood up to the time of death.

The merione which was inoculated subcutaneously showed trypanosomes in its blood on the eighth day, and died on the 31st day. The course of the infection was marked by three crises, and at the time of death parasites were very scantily present in the blood.

In the gerbils inoculated subcutaneously and intraperitoneally the periods of incubation were nine and two days respectively, but death took place on the 19th day in both cases.

* Meriones: a genus of Muridae.

- (10) LAVERAN (A.). Diminution de virulence chez des trypanosomes ayant subi un grand nombre de passages par animaux de même espèce. [The Diminution in Virulence of Trypanosomes that have been passed through a Long Series of Animals of the Same Species.]—*Bull. Soc. Path. Exot.* 1916. Feb. Vol. 9. No. 2. pp. 109-117.

The author has frequently found that, when strains of trypanosomes are maintained by passing them from animal to animal of the same species for long periods, there is a tendency for them to lose virulence for that species to such an extent that not only is the period of incubation prolonged and the course of the disease lengthened but actual recovery may take place. In such cases there is a risk of losing the strain, and the best way of reviving the virulence is to transfer it to an animal of another species and maintain it in that species for a time before using it again for the inoculation of animals of the species originally employed.

In this paper details are given of a number of experiments with a strain of *T. congolense* and a strain of *T. gambiense* illustrating these points.

- (11) RODHAIN (J.). Note sur les Trypanoses et les Piroplasmoses des grands animaux de l'Ouelié. [Note on the Trypanosomiases and Piroplasmoses of Large Animals of the Ouellé District.]—*Bull. Soc. Path. Exct.* 1916. Feb. Vol. 9. No. 2. pp. 95-109. With 1 text-fig.

In this paper the author describes parasites encountered in the north-eastern portion of the basin of the Congo.

Among 89 domestic cattle examined 13 were found to be infected with *T. congolense* and *T. cazaloui*. Of nine sheep one was found to be infected with *T. congolense*. The examination of the blood of nine Equidae and 21 kids was negative in every case.

These figures must not be taken as indicating the percentage of animals infected, as circumstances prevented the author from carrying out full investigations. It was practically only those animals which showed clinical evidence of infection that were examined.

It is remarkable that no dimorphic trypanosomes were found.

As wild animals form the reservoir from which the domesticated animals derive their infection, a certain number of these were also examined. Although blood from 50 animals belonging to twelve species was examined either between a slide and coverglass or in stained preparations, not a single one was found to harbour pathogenic trypanosomes. There is no doubt, however, that if it had been practicable to carry out systematic inoculations infected animals would have been detected.

The author draws special attention to the fact that in none of the districts where the game were examined was *Glossina* present in large numbers.

A trypanosome of the *ingens* type was found in the blood of one *Cephalophus dorsalis*.

Three species of *Glossina*, *G. palpalis*, *G. morsitans*, and *G. fusca*, are found in the Ouellé territory. The development of trypanosomes in the first two species is fairly well known, but little is known regarding their development in *G. fusca*. Six infected individuals of this species were found among 26 dissected. In four instances the multiplication of the parasites was limited to the proboscis. In two the multiplication was taking place in the intestine and the proboscis. In no case was there any invasion of the salivary glands.

In one case in which multiplication was going on in the proboscis only the process was complete, as metacyclic or salivary forms were found in the lumen of the tube.

In view of what is known regarding the development of trypanosomes of the *cazalboui* and of the *congolense* types in the other species of *Glossina* it would appear to be probable that *G. fusca* is capable of transmitting these species.

Bovine piroplasmoses.—

Piroplasma bigeminum has been found once only.

A parasite referred to as *Theileria mutans* appears to have a wide distribution in the Ouellé region. In order to exclude the possibility of this parasite being in reality *T. parva*, the author carried out a number of gland punctures, but failed to find any developmental forms of the parasite.

The author refers to the parasite under the name mentioned because of the morphological resemblance to *T. parva*. He has not been able to carry out any experimental inoculations with blood.

At Doungou, Renzi, and Amadis the author was struck by the poor development of many of the calves, and is inclined to attribute it to infection with piroplasms during very early life.

Ovine piroplasmosis.—The author confirms the occurrence of piroplasmosis in sheep and states that the disease appears to have a wide distribution.

Morphologically the parasite resembles *T. mutans* but differs from it in the almost complete absence of bacillary forms. In Romanowsky preparations the majority of the parasites appear rounded or oval, with a few comma-shaped forms. The chromatin is always marginal and solid-looking. In the young parasites it is in the form of a rounded mass, but in the ring-shaped parasites it is elongated and lies along the periphery of the ring.

Multiplication is generally by binary fission. In blood that is heavily invaded and in which multiplication is progressing rapidly cross-forms which have been described as typical of the genus *Theileria* may occur.

The author suggests the name *Theileria ovis* for this parasite. He has also constantly found in the red corpuscles of the infected sheep bodies resembling anaplasmata. He is not convinced as to their parasitic nature.

In transmission experiments from sheep to sheep these bodies have made their appearance in a rather irregular manner, before, simultaneously with, or after the appearance of the piroplasms. They are not constant in size, some measuring less than one micron in diameter and others being nearly twice this size. It is possible that these are two distinct structures. The larger ones are said to resemble nuclear remains.

Attempts to differentiate between *T. ovis* and the anaplasma (?) by means of trypanblue failed because the drug did not cause the complete disappearance of the piroplasm.

The lesions found in an animal killed for the purpose of post-mortem examination were as follows: There was marked emaciation, no bile staining of the tissues, petechiae in the subcutaneous connective tissue and at the apex of the heart, in the right ventricle and on the abdominal surface of the diaphragm. Slight oedema at the base of the lungs, spleen normal, liver enlarged and congested. Kidneys enlarged, capsule easily stripped. Traces of albumen in the urine. Cervical glands slightly engorged.

A few inoculation experiments were carried out, but no definite conclusions can be based on the results. They appear to indicate however, that young kids are susceptible to a slight extent, and that the inoculation of young lambs gives rise to a slight but chronic infection. Some of the negative results obtained with adult animals may possibly be explained on the hypothesis that immunity is acquired early in life.

The parasites persist in the blood for long periods, and any depression of the vitality of the animal is followed by an increase in their number.

In the course of his investigations the author has found two specimens of *Cobus defassa* infected with a piroplasm morphologically resembling the larger forms of *T. mutans*.

A single cross-bred dog of European origin was found to be infected with piroplasmosis. Examination of a number of native dogs failed to reveal a single case of infection.

The author gives the following list of flies which he captured and identified:—*Stomoxys calcitrans*, *Lyperosia minuta*, *Lyperosia punctigera*, *Glossina palpalis*, *G. morsitans*, *G. fusca*, *Chrysops silviced*, *C. distinctipennis*, *C. funebris*, and another species as yet unidentified, *Tabanus socius*, *T. secedens*, *T. ruficrus*, and *T. biguttatus*, and a series of other species not yet identified, including a large group of *Chrysozona* [*Haematopota*].

- (12) SERGENT (Ed.) & LHÉRITIER (A.). Longue incubation ou latence d'infections à trypanosomes chez des chiens inoculés avec des virus provenant de chèvres. [Long periods of Incubation or Latent Infection in Dogs inoculated with Virus derived from Goats.]—*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 653-655.

The authors record the occurrence of a period of incubation of 2 months and 24 days in a dog inoculated with 100 cc. of blood from a goat infected with *T. marocanum*, while another inoculated with 110 cc. of blood from a similar source showed a period of incubation of 7 months and 11 days.

In a dog inoculated with 110 cc. of blood from a goat infected with *T. berberum* the period of incubation was exactly 8 months, while in another case it was 5 months and 13 days.

In these cases the course of the disease was exactly the same as in cases in which the period of incubation is of the ordinary length.

The blood of the dogs was examined thrice weekly.

- (13) MACFIE (J. W. Scott). A Note on a Trypanosome of the Black Rat (*Epimys rutilus*).—*Ann. Trop. Med. & Parasit.* 1915. Dec. 30. Vol. 9. No. 4. pp. 527-534. With 1 plate comprising 18 figs.

The trypanosome described in this paper was found in a black rat at Accra. The parasites were present in the blood in enormous numbers and, though of the *lewisi* type, they were found to be remarkably polymorphic. Two types of motility were observed, one when the parasites were progressing rapidly, which involved the whole of the body, and the other when the parasites were stationary, in which there was a rapid vibration of the anterior extremity of the body.

In a stained preparation measurements were made of a hundred consecutive individuals, and it was found that the length ranged from 15 to 48 microns, about half of them being upwards of 30 microns in length. The breadth varied from 2 to 6 microns, but the majority approximated to the smaller measurement. These measurements do not represent the maximum and minimum, as an individual measuring 52 microns, and one measuring 12 were found. Aggregations of dividing forms were also observed.

In all forms the posterior end of the body was long and tapering. The micronucleus was often oval or rod-shaped. The nucleus was placed well forward in the body. The undulating membrane was poorly developed, and there was a free portion to the flagellum. The body was generally quite free from granules. In some of the small forms the micronucleus was close to or even in front of the nucleus. In some of the largest specimens the posterior extremity of the body was prolonged into a whip-like lash and there were forms connecting these with the smaller types. In some of these large forms the length from the micronucleus to the posterior end of the body was as much as 24 microns.

The types of trypanosomes in the blood differed from day to day, and the author thinks that the parasite may be identical with *T. eburneense* described by DELANOË, although that author made no mention of the forms with the posterior prolongations.

Inoculation of a white rat and a guinea-pig failed to set up infection.

The author notes that BROWN'S* observations regarding a pathogenic strain of *T. lewisi* may possibly indicate that *T. eburneense* is a variety of *T. lewisi*.

- (14) MESNIL (F.) & BLANCHARD (M.). Sensibilité au sérum humain normal de Trypanosomes d'origine humaine. [The Susceptibility of Trypanosomes of Human Origin to Normal Human Serum.]—*Bull. Soc. Path. Exot.* 1916. Feb. Vol. 9. No. 2. pp. 81-85.

The authors give details of three experiments with regard to the action of human serum upon a strain of *T. gambiense*.

The results may be summarised as follows:—

Up to the present five strains of human trypanosomes have been studied in connection with the effects produced by human serum upon them. Two strains of *T. rhodesiense* have shown themselves to be

* See this *Bulletin* 1914, Sept. Vol. 2. No. 3. p. 130, & 1915, June. Vol. 3. No. 2. p. 48.

relatively susceptible to the action of human serum. A strain of *T. gambiense* studied by LAVERAN has proved itself to be resistant after having been maintained for 12 years in laboratory animals.

A strain of *T. gambiense* carried on by the authors when tested for the first time seven years after isolation from the human subject possessed a somewhat slight degree of susceptibility. During the last four years the degree of susceptibility has been slightly variable and at present it is about the same as that of *T. rhodesiense*.

The Lanfranchi strain about two years after its isolation possesses about the same degree of susceptibility as *T. rhodesiense* and the author's strain of *T. gambiense*.

- (15) VAN DEN BRANDEN (F.). Valeur moyenne de la durée de stérilisation sanguine chez les trypanosés par une dose de salvarsan, néosalvarsan, salvarsan cuprique et sel sodique du salvarsan cuprique. [The Average Duration of the Sterility of the Blood of Persons infected with Trypanosomiasis produced by Salvarsan, Neosalvarsan, Copper Salvarsan, and the Sodium Salt of Copper Salvarsan.]—*Bull. Soc. Path. Exot.* 1916. Jan. Vol. 9. No. 1. pp. 13-15.

In tabular statements the author gives details of cases of trypanosomiasis treated by the drugs mentioned in the title of his paper. The cases were selected, the patients being in good condition, and the cerebro-spinal liquid normal.

Salvarsan.—A single dose of 0·01 g. per kilog. produced sterilisation of the blood for periods ranging from two to eight months.

Neosalvarsan in a dose of 0·013 g. per kilog. appeared to be effective for periods ranging from 4 to 22 months.

Copper salvarsan in a dose of 0·004 g. per kilog. cleared the blood of trypanosomes for periods ranging from 19 to 24 months.

The sodium salt of the foregoing in a dose of 0·0053 g. per kilog. was effective for periods ranging up to 12 months.

Four cases were treated with each drug, and it is pointed out that the periods in some cases may in reality be longer than stated as the patients have to be examined again.

LEISHMANIASIS.

- (16) LAVERAN (A.). Nouvelle contribution à l'étude des infections expérimentales de la souris par *Leishmania tropica*; un cas d'infection de la gerbille. [Experimental Infection of the Mouse with *Leishmania tropica*, and a Case of Infection in the Gerbil.]—*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 680-686.

The author gives the details of two white mice and a gerbil inoculated with *L. tropica*, in each of which there were lesions about the tibio-tarsal articulations. The two mice were inoculated intraperitoneally from another mouse, and the gerbil was inoculated intraperitoneally on seven occasions with cultures of the same parasite. In one of the mice there was a general infection, but in the other two animals the

lesions were limited to the scrotum and the skin. The parasites were present in large numbers in the serous exudate around the affected joints. In the gerbil there was also ulceration of the nose.

The author draws attention to the fact that the gerbil is common in areas where oriental boil is endemic, and suggests that although natural infection in this animal has never yet been recorded it may nevertheless prove to be the reservoir of the virus.

The infection is not invariably fatal in the mouse, as in one instance a mouse which had been inoculated 11 months previously and developed typical lesions in which the parasite was found, had apparently made a complete recovery four months before it was killed. At the post-mortem no trace of infection could be found.

Attempts to infect mice by ingestion and through the medium of fleas have constantly given negative results.

The author states that he has inoculated at different times 47 mice with *L. infantum* and *L. donovani*, but in no case have any lesions of the skin been observed.

- (17) TOWNSEND (C. H. T.). The Insect Vector of Uta, a Peruvian Disease.—*Jl. of Parasitol.* 1915. Dec. Vol. 2. No. 2. pp. 67-73. With 4 text-figs.

The author's summary is as follows:—

"1. The disease known as *uta* occurring on the west face of the Andes in Peru, has been proved to be due to Leishmania.

"2. Two species of *Forcipomyia*, native to the western Andean region, appear to be proved to be capable of transmitting the Leishmania of Uta.

"3. It is highly probable that the various forms of Leishmaniasis thus far known are due to as many species of herpetomonads originally parasitic in the gut of the insect-carriers concerned, and that, with regard to the occurrence in man, these herpetomonads are as yet in the stages of parasitism ranging from habitually abnormal or frequent to mere accidental or infrequent."

UNDULANT FEVER.

- (18) NICOLLE (Ch.) & GOBERT (E.). Seconde enquête sur les chèvres laitières de Tunis au sujet de la fièvre méditerranéenne. [Second Inquiry into the Distribution of Mediterranean Fever among Milch Goats in Tunis.]—*Bull. Soc. Path. Exot.* 1916. Feb. Vol. 9. No. 2. pp. 86-95.

The prohibition of the importation of goats from Malta into Tunis was followed by a marked diminution in the number of cases of Mediterranean fever in the human subject. In 1909, when the importation was stopped, 40 positive results were obtained in agglutination tests carried out with human serum at the Pasteur Institute at Tunis. This figure rose to 63 in 1911 and then rapidly fell, so that in 1914 only 7 positive results were obtained. In this connection it may be noted that only those cases were considered positive in which the agglutination titre was higher than 50.

The second enquiry into the disease was instituted because during 1915 the number of cases rose again to 40.

The investigations were carried out during the last six months of the year, and the following animals were examined : 2,354 goats, 14 donkeys, 9 cows, 7 dogs, 4 horses, and 2 cats.

Of the goats 1,277 were Maltese, and 1,044 Arab, the remainder being crosses.

The emulsion used in the agglutination tests was prepared from a strain of the organism isolated in 1909 from a Tunisian goat, and was the one used in the tests of human patients. The liquid used in the preparation of the emulsion was 7 per mille sodium fluoride. The emulsion contained 800 million bacteria per cc. Sodium fluoride is said to be valuable for the preparation of the emulsion as it preserves the chief reactions of the bacteria for long periods without sensible loss. The authors consider that emulsions prepared in this way are as sensitive as living cultures. Provided such an emulsion be kept at a low temperature, it may remain in a suitable condition for two years.

The experience gained by the authors in carrying out tests with human serum and the fluoride emulsion lead them to consider reactions below 1 in 20 as doubtful, reactions from 1 in 40 to 1 in 60 very suspicious, and those in higher dilutions as definitely positive.

Judging on this standard, the results obtained with the sera of the goats tested showed that of the total number (in round figures) 97 per cent. gave negative or doubtful reactions and 3 per cent. gave suspicious or positive reactions.

The figures for the Maltese goats alone show that 95 per cent. gave negative results and 5 per cent. suspicious or positive reactions.

The Arab and cross-bred goats yielded 99·3 per cent. negative results and 0·7 per cent. indicating probable infection.

The herds examined could be divided into four groups according to the locality in which they were placed, and on examining the figures given by the different groups it was found that the percentage of affected animals was markedly different in the various groups, those herds giving the higher percentages in which the larger number of Maltese goats was included. It was further found that the distribution of the infection was not even in any one group.

On comparing the distribution of the cases of the disease in the human subject with that of the cases in the goats it was found that the areas giving the greater numbers of cases coincided.

It is suggested that, although up to the present the disease has been found to be far more frequent in the Maltese than in native goats, the organism may in time acquire an exalted degree of virulence for the native animals or the cross-breds than for the Maltese animals.

The authors lay down regulations based upon those in operation in Malta for the control of the disease.

RABIES.

- (19) PHISALIX (Marie). Les propriétés vaccinantes de la sécrétion cutanée muqueuse des Batracians contre le virus rabique sont indépendantes de celles qu'elle possède contre sa propre action et contre celle du venin de Vipère aspic. [The Vaccinating Properties of the Mucoid Cutaneous Secretion of Reptiles against the Virus of Rabies are Independent of those which it possesses against its own Virus and that of the Adder.]—*Bull. Soc. Path. Exot.* 1915. Dec. Vol. 8. No. 10. pp. 730-731.

In experiments carried out by the author two axolotls or three brown frogs were placed in a vapour of ether and then washed with 15 cc. of distilled water. To the solution of the mucoid secretion thus obtained was added a little ether, and the mixture was placed in an ice chest for 48 hours. The liquid then had dissolved in it 10 mg. of dried adder venom. In sealed pipettes the liquid was heated in a water bath for 15 minutes at 75° C. The effect of this was to destroy the toxicity of the venom without altering its protective properties, nor those of the mucoid secretion.

The mixture was injected every second day in doses increasing from 1 to 5 cc. into the aural vein of rabbits. On the third day after the final injection the rabbits were inoculated intracranially with fixed virus. None of the animals developed rabies.

Subsequent inoculations with fixed virus at intervals of two, three, and four months showed that the immunity that had been acquired lasted for about two months.

It is pointed out that the immunising substance or substances do not result from a chemical reaction between the components of the mixture, nor from the heating, as the same results can be obtained if the secretion and the venom are injected in succession whether heated or unheated.

Whereas the mucus from the skin of the adder is both toxic and protective against its own action and protective against that of the salamander, that of the frog possesses neither of these properties, but is nevertheless protective against the virus of rabies. The conclusion must therefore be drawn that the substance present in the mucoid secretions of reptiles which immunises against the venoms is not the substance which immunises against rabies.

This secretion is also interesting from the fact that it is capable of developing physiological properties without undergoing any physical change. In *Proteus anguinus* and *Dactylethra laevis* it is innocuous, and justifies the comparison that has been made between it and the sweat of mammals. In *Rana temporaria* it exhibits powers of producing inflammatory conditions. In *Rana esculenta*, *Alytes obstetricans*, *Salamandra maculosa*, and *Siredon mexicanus* it is clearly toxic. It is only protective in its action against the toxic mucus and venom of *Vipera aspis* in *Siren lacertina*. In *Rana temporaria*, where it is neither toxic nor protective, it possesses the power of protecting against rabies.

- (20) ZELL (C. A.). Rabies, Diagnosis and Treatment.—*Amer. Jl. Vet. Med.* 1915. Nov. Vol. 10. No. 11. pp. 835-836 and 887-890.

The author has found that the complement fixation test can be used for the diagnosis of rabies if the antigen be prepared from the submaxillary glands of rabid dogs. The antigen is prepared by excising the glands, mincing them, and placing them in distilled water under a vacuum of 28 inches for at least an hour. The turbid liquid which is obtained is filtered through a Berkefeld filter. This antigen deteriorates rapidly, and it was found that an alcoholic extract made according to the Wassermann technique could be used equally well. In experimentally infected animals positive results were obtained several days before any symptoms were shown, the diagnosis being confirmed by the discovery of Negri bodies.

On one occasion the author's attention was drawn to a case of rabies in a horse in a barn where fifty other horses were stalled. The animal was too violent to permit any blood being taken, but blood was obtained from all the other horses and five gave positive reactions. The team-mate of the horse killed, the team stalled next to it, and two other horses known to have been bitten by the rabid horse gave positive results. These animals were treated and remained healthy.

With regard to the Pasteur treatment, the author's observations lead him to the conclusion that no antibodies can be demonstrated in the blood until three weeks after the completion of the treatment. This explains the occasional deaths occurring in people bitten about the face and neck.

The author has produced an immune serum by hyperimmunisation against street virus. A number of guinea-pigs were treated with immune serum on three occasions. They were then inoculated after an interval of a week with virus, some being done subdurally, some intramuscularly, and some into the anterior chamber of the eye. The first group nearly all died of rabies, while the majority of the remainder proved to be immune.

Guinea-pigs inoculated with rabies and then given injections of serum died if the interval elapsing between the inoculation with virus and the administration of serum was more than two days. The results obtained when the virus and serum were mixed were very similar to those obtained when the virus was given after the serum.

The five horses referred to above which yielded positive results to the complement fixation test were treated with the author's protective serum.

PROTOZOA.

- (21) MACFIE (J. W. Scott). A Case of Dysentery in a Monkey, in which Amoebae and Spirochaetes were found.—*Ann. Trop. Med. & Parasit.* 1915. Dec. 30. Vol. 9. No. 4. pp. 507-512. With 1 plate comprising 12 figs.

The monkey referred to in this paper was one infected with a strain of human trypanosome which was sent to the author at Accra. The animal died on the 65th day after inoculation and at the post-mortem

examination, apart from general emaciation and anaemia, the most marked lesions were severe ulceration of the large intestine and enlargement of the spleen. The lymphatic glands were not enlarged, and the monkey had shown no symptoms of trypanosomiasis during life.

In preparations from the contents of the large intestine numerous amoebae were found. The organisms in stained preparations measured from 12 to 30 microns in diameter, but the great majority approximated to the smaller measurement. Some of the larger ones contained a number of red blood corpuscles. Numerous cysts were seen which possessed a thick wall and contained a single large vacuole. In the narrow band of cytoplasm a number of faintly stained nuclei could be detected.

In addition to these amoebae immense numbers of spirochaetes were present in the contents of the large intestine. They ranged from 4 to 7 microns in length, were very slender, and had pointed extremities. Few of the parasites showed more than two coils. The author does not think that the spirochaete was pathogenic and draws attention to the fact that it very closely resembled *S. eurygyrata*, which has been found in the faeces of apparently healthy people.

- (22) SCOTT (J. W.). *Some Notes and Experiments on Sarcocystis tenella, Railliet.*—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1. pp. 20-24.

It has been suggested by DARLING that "the sarcosporidia may be varieties of Neosporidia of invertebrates which have invaded the muscular tissue of a host where they cannot complete their development and from which they cannot escape." The author of the present paper has made some observations which tend to favour a similar view, but of this he has not as yet obtained any experimental evidence.

It would appear that the range sheep of Wyoming are infected with the parasite to an extent ranging from about 70 to 100 per cent. No parasites in the Balbiana stage have been seen. An experiment in which five young lambs were fed with pieces of heart muscle containing the parasite yielded an entirely negative result, and control lambs kept under the same conditions were also found to be free from infection at the time of slaughter.

In view of the suggestions that have been put forward by various authors that the parasite must have an intermediate host, the author carried out an experiment to test whether the parasite might be liberated by digestion in a carnivorous animal and thus rendered capable of infecting fresh animals.

A dog was fed twice with heavily infected heart muscle from sheep, and after a few days when the grass upon which the cage stood was well covered with faeces two lambs were placed in the cage where they remained 33 hours. After an interval of about three weeks a further pair of lambs were placed in the cage and left for 24 hours. None of these became infected.

In another experiment two groups of animals were kept respectively upon a pasture that was partly swampy and partly dry and one that was very dry. Infected muscle was scattered over both. When the lambs were killed 55 per cent. of those on the swampy ground were found to be infected, and 21 per cent. of those on the dry pasture.

It is pointed out, however, that these infections were probably contracted naturally, as the feeding of infected muscle direct to animals failed to cause infection.

If the view be taken that the presence of sarcosporidia in sheep is more or less accidental, the difference in the percentage of animals infected upon the two pastures may be explained in another way. The conditions in the pasture that was partly swampy favoured the occurrence of various insects, and the possibility is suggested that the sheep might become infected in a more or less accidental manner by ingesting either the insects which are the hosts of the parasite or their droppings.

This explanation favours DARLING's view that the sheep is not the definitive host of the parasite.

- (23) RODHAIN (J.). *Quelques hématozoaires de petits mammifères de l'Uele (Ouellié), Congo Belge.* [Some Haematozoa of Small Mammals at Uele, Belgian Congo.]—*Bull. Soc. Path. Exot.* 1915. Dec. Vol. 8. No. 10. pp. 726-729. With 3 text-figs.

Trypanosoma dendromysi n. sp.—This parasite was found in the blood of a climbing mouse (*souris grimpeuse*) which has not yet been identified, but is fairly common at Aba on the border of the Mongalla district. Five out of six mice examined were found to be infected.

In the fresh state the parasite, which is of moderate size, executes slow translatory movements which allow of a fairly close study of the changes of shape shown by it during the process.

The nucleus, which is oval or rounded, is situated in the anterior third of the body. The blepharoplast is very small and is marginally placed at a little distance from the posterior end. The undulating membrane is narrow and is bordered by a flagellum of which about one third is "free." The body contains no granules, but sometimes shows one or more vacuoles. The length of the parasite ranges from 30 to 33 microns and the width from 4 to 5. The free portion of the flagellum measures about 10 microns.

The parasites were always very scanty in the blood. Intraperitoneal inoculation of a guinea-pig and a young savannah mouse failed to cause infection in either.

Haemogregarine of *Cricetomys gambianus*.—The parasite found in the red corpuscles of this animal closely resembles *Haemogregarina balfouri*.

The invaded cells become elongated and pale in colour. In the cells the parasites appear as vermicules with rounded ends, and are sometimes slightly curved. They measure about 10 microns in length and rather less than 4 in width. The nucleus, which is generally placed towards one end, occupies about two-thirds of the body.

Grahamella was also present in the blood of the infected rats.

Plasmodium of *Epomophorus franqueti*.—The author has found male and female forms of a plasmodium in the blood of four flying foxes, and diagrams of these are given.

- (24) FANTHAM (H. B.) & PORTER (Annie). Some Experimental Researches on Induced Herpetomoniasis in Birds.—*Ann. Trop. Med. & Parasit.* 1915. Dec. 30. Vol. 9. No. 4. pp. 543-558. With 1 plate comprising 40 figs.

The authors record the successful infection of birds with *Herpetomonas jaculum* from the water scorpion, and *H. culicis* from *Culex pipiens*.

The birds used were canaries, sparrows, and martins. In the feeding experiments the birds were fed either with the entire insects or with their alimentary canals only. The insects used—*Nepa cinerea* and *Culex pipiens*—were obtained in the neighbourhood of Cambridge.

A canary fed with material containing *H. jaculum* died on the 51st day. A film of blood made on the 21st day showed elongating post-flagellate forms of the parasite. Parasites were found a fortnight later when the bird showed evidence of being ill. There were also symptoms of illness on the day of death. During the course of the experiment the bird's weight fell from 26 g. to 10·2 g.

Preparations made from the organs showed that the liver contained leishmaniform bodies, a few elongating forms and flagellate forms in very small numbers. Leishmaniform types and developing forms were found in spleen, heart, lungs, and kidneys. Although the suprarenal bodies were very firm they showed no parasites.

An experiment in which a sparrow was fed with *Culex pipiens* terminated with the death of the bird on the 9th day. In this case also there was a generalised infection with *H. culicis*, but no parasites were found in the blood or in the intestine. Examination of the blood 14 hours before death occurred revealed a single organism in the process of elongating.

A small number of other experiments are briefly recorded in which the results obtained were similar to those referred to.

In a single inoculation experiment the bird, an adult martin, died after two days. No evidence of infection could be detected.

It is noted that in the more chronic infections the leishmaniform parasites predominated, while in the acute cases the flagellate forms were more numerously present, but that the experiments are as yet too few in number to warrant any general conclusions being drawn with regard to this.

H. jaculum in the non-flagellate forms is oval, and shows a nucleus and a well marked blepharoplast. The flagellate form is produced by a process of elongation, which is often preceded by division of the nucleus and blepharoplast, and the development of the flagellum. When need arises for a new host the flagellum is absorbed, the body becomes concentrated, and a thin cyst wall is produced. This form of the parasite is adapted to existence outside the host. When ingested by a new host the leishmaniform parasite is again produced.

In the experimentally infected canary the non-flagellate forms were from 4 to 6·6 microns in length by 2 to 5 in breadth. They were generally found singly. Dividing forms of the parasite at this stage were not numerous. In the flagellate stage the parasites resembled those present in the insect, but they did not attain so great a length.

The life-cycle of *H. culicis* is similar to that of the foregoing parasite. In the non-flagellate stage the parasites are about the same size.

although a few larger forms were encountered in *H. culicis* than in *H. jaculum*, and various stages of division were also found. The body of the flagellate forms ranged from 11 to 16 microns in length, and the flagellum was often about the same length. The parasites varied in width from 8·5 to 3·6 microns.

In all cases the parasites were far more numerous in the internal organs than in the circulating blood.

Among the general conclusions drawn it is stated that the various species of Leishmania are probably insect herpetomonads usually perpetuating the non-flagellate stage which is the more resistant, and a summary of the evidence tending towards this conclusion is given.

- (25) WEIDMAN (F. D.). *Coccidium bigeminum* Stiles in Swift Foxes (Habitat Western U.S.)—*Jl. Comp. Path. & Therapeut.* 1915. Dec. Vol. 28. No. 4. pp. 320-323. With 3 text-figs.

This parasite was found in two swift foxes, both of which were suffering from diarrhoea. One of the animals was passing large numbers of oocysts and the infection terminated fatally. In the case of the other animal the parasites were present in the faeces in small numbers only, and spontaneous recovery took place.

In fresh faeces double-contoured cysts with one or two spores may be found. Some of them are nearly spherical, measuring about 30 microns in each diameter. Others may be as long as 40 microns.

In faeces diluted with tap water and kept under observation continuously it was found that the single-spore forms divide by a process of constriction in from four to six hours. Within 24 hours each spore acquired a double-contoured envelope and contained four banana-shaped sporozoites and a granular residual body. This subsequently became hyaline.

Post-mortem examination revealed extensive haemorrhagic ulceration of the small and large intestines. The ulcers extended down to the muscularis mucosae. No parasites were found in the epithelial cells, but two or three naked protozoa measuring from 15 to 21 microns in their long diameter were found on the margins of ulcers. Double-contoured forms were also found on the surface of the mucous membrane.

The parasites observed in these animals appear to be larger than those previously described as occurring in the dog and the cat, and the author therefore suggests the name *caniveloci* for this variety. Although parasites of this species are not generally credited with possessing pathogenic properties, it would appear that in one of these cases they were responsible for death.

- (26) MINCHIN (E. A.). Remarks on the Nature and Significance of the so-called "Infective Granules" of Protozoa.—*Ann. Inst. Past.* 1915. Nov. Vol. 29. No. 11. pp. 537-544. With 2 text-figs.

The author points out that the term "granule" used by FRY and RANKEN and other authors for small bodies extruded by protozoa is in reality a misnomer. The particles are not cell-granules, but endogenous buds which when complete have the morphological and

cytological value of true cells. To establish this interpretation the author points out that many examples of endogenous budding are known among the protozoa, and special reference is made to the process occurring in an amoeba described by LISTON and MARTIN. The processes observed in this organism are compared with those described by FRY and RANKEN as occurring in trypanosomes.

In LISTON and MARTIN's observations the amoebae were seen to extrude tiny buds from their cytoplasm which moved away and subsequently grew to the size of the parent organism. In fixed preparations numerous chromidial grains could be seen in the cytoplasm, and in the process of bud-formation a quantity of cytoplasm became separated off round a group of these grains which became clumped in the centre, the whole structure being then extruded. The principal nucleus of the organism took no part in this process of reproduction. Several such buds could be seen in a single amoeba.

In the corresponding process in the trypanosomes a small group of chromatin grains are extruded by the trophonucleus. These pass to the surface and are cast out. As they increase in size the differentiation of the trophonucleus and the kinetonucleus becomes apparent. Later a flagellum grows out from the neighbourhood of the kinetonucleus, and the organism develops into a trypanosome. The apparent absence of any cytoplasm in the buds formed by trypanosomes is explained as being a defect of the Romanowsky method of staining.

The author concludes that "infective granule" is a misleading term and that it should be replaced by "endogenous bud-formation."

HELMINTHS.

- (27) WEIDMAN (F. D.). *The Distribution of Uncinaria among the Lower Animals.*—*Jl. Comp. Path. & Therapeut.* 1915. Dec. Vol. 28. No. 4. pp. 323-326.

During the past thirteen years fourteen cases of uncinariasis have been found in animals autopsied at the Zoological Gardens, Philadelphia. The tabular statement on following page shows the distribution of these parasites.

It is seen that seven of the cats came from districts where hookworm disease occurs.

The paper contains a short summary of the previously recorded cases of uncinariasis in animals.

- (28) LINTON (E.). *Cestode Cysts from Muskrat.*—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1. pp. 46-47. With 1 text-fig.

In this short paper the author describes the occurrence of four cysts in a muskrat—three in the liver and one in the peritoneum—which proved on examination to be *Cysticercus fasciolaris*.

[March, 1916.]

TABLE SHOWING INCIDENCE OF UNCINARIA.
[WEIDMAN (F. D.).]

Autopsy Number.	Year.	Name of Animal.	Habitat.	Number of Males.	Number of Females.
919	1906	Grey wolf	Western United States	8	2
1001	1907	Grey fox	Western United States	34	33
11157	1907	Jaguarundi	South America	3	4
1715	1909	Wild cat (<i>Felis rufus</i>)	South Carolina	1	1
2241	1911	Arctic fox	Arctic regions	5	3
2392	1911	Wild cat (<i>Felis rufus</i>)	South Carolina	0	1
2644	1912	Wild cat (<i>Felis rufus</i>)	South Carolina	7	13
3037	1913	Sea lion	California	56	42
3221	1914	Swift fox	Western United States	0	4
3293	1914	Wild cat (<i>Felis rufus texensis</i>)	North Mexico and Texas	11	10
3297	1914	Wild cat (<i>Felis rufus texensis</i>)	North Mexico and Texas	10	14
3298	1914	Wild cat (<i>Felis rufus texensis</i>)	North Mexico and Texas	4	3
3306	1914	Red fox	North America, Eastern United States	1	1
3561	1915	Wild cat (<i>Felis rufus</i>)	South Carolina	0	1

- (29) SEURAT (L.-G.). Sur les premiers stades évolutifs des Spiroptères.
[The First Stages of Development of the Spiroptera.]—*C. R. Soc. Biol.* 1915. Nov. 19. Vol. 78. No. 17. pp. 561–565. With 5 text-figs.

In this paper the author traces the changes passed through by the larvae of certain Spiroptera in the intermediate host.

The coprophagous Coleoptera frequently contain in their body-cavities larval nematodes enclosed in capsules produced by a proliferation of the epithelium.

These are sometimes present in very large numbers. The larger capsules contain a larva 3 or 4 mm. in length, which is that of the Spiroptera of the dog. The smallest capsules contain one or more larvae which vary in length from 9 to 1.7 mm. in length and are characterised by a long tubular buccal cavity and two asymmetrical cervical papillae. This parasite the author believes to be *Physocephalus sexalatus*, which is apparently the same as that imperfectly described by LINSTOW as *Spiroptera (Filaria) strigis*.

These two larvae closely resemble each other, and a special feature of the resemblance is the possession of a prominent ventral and dorsal lip to the mouth, and the termination of the tail in a rounded button furnished with points. They also possess two lateral cervical papillae which may be placed symmetrically or asymmetrically. They also show two asymmetrical papillae on the upper border of the lateral areas in the region of the intestine.

In addition to these encapsulated forms free larvae are found.

The eggs of the Spiroptera of the dog and of *Physocephalus sexalatus* hatched out on a hollow slide produce larvae about 130 microns in length, the anterior extremity of which is blunt and armed with a short projection for the purpose of perforating, and the tail is conical.

The larvae of the first stage are 420 microns in length and about one-tenth of that in thickness. The head is rounded and carries a short boring apparatus. The tail is short and bluntly conical. On the ventral surface about the anterior fourth of the length of the body there is a pear-shaped vesicle with an excretory pore. The larvae in this stage are of particular interest as they are on the point of undergoing their first moult.

The larvae of the second stage are likewise free in the abdominal cavity of their host and only become encapsulated after the second moult. A large and a smaller parasite have been found, which the author thinks are *Spirocercus sanguinolenta* and *Physocephalus sexalatus* respectively. The larva of the second stage of the latter parasite is relatively slender, the head is rounded and the tail rounded and quite smooth. The excretory pore opens about 77 microns from the anterior extremity at the summit of a slight cuticular elevation. The anus has a prominent posterior lip. The buccal cavity measures 28 microns, and the oesophagus is about one-third the length of the body. The rudimentary genital apparatus is represented by an ovoid undifferentiated cellular structure applied to the ventral face of the intestine about the mid-point of its length.

The larvae of *Ph. sexalatus* when they measure about 0.8 mm. have reached their maximum development and are ready to undergo their second moult. In the cephalic extremity the head of the larva of the

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third stage can be seen with its two dorsal and ventral lips, and the narrow tabular buccal cavity. At the caudal extremity the truncated end with a rounded boss covered with spicules can be made out. The second-stage larva only undergoes a second moult after encapsulation.

The second-stage larva of *Sp. sanguinolenta* closely resembles that just described, but is larger, the buccal cavity is more spacious, its walls are thicker, and the nerve ring occupies a more posterior position.

- (30) LEIPER (R. T.). Report on the Results of the Bilharzia Mission in Egypt, 1915. Part III.—*Jl. Roy. Army Med. Corps.* 1915. Sept. Vol. 25. No. 3. pp. 253–267. With 3 plates & 5 text-figs.

In this portion of the report the author deals with the development in the intermediary host, the penetration of the definitive host, and the development of the parasite in the definitive host.

The life-cycle of the digenetic trematodes may be concisely expressed by the scheme which the author gives (see page 29).

In the case of Bilharzia the development in the intermediate host is as follows:—The miracidium gives rise to a sporocyst which in turn gives rise to daughter-sporocysts. These migrate into the digestive gland and grow rapidly, becoming elongated and ramifying throughout the organ, which becomes greatly atrophied.

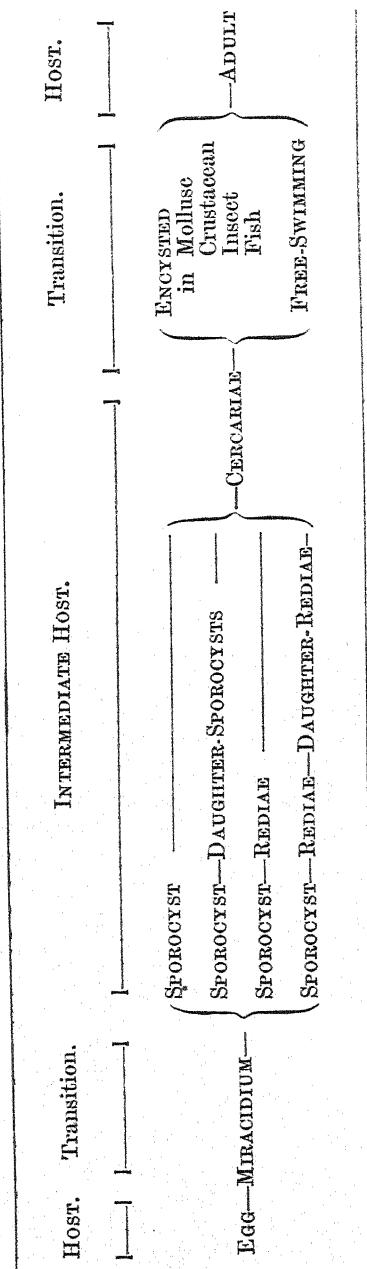
The sporocysts are not provided with any alimentary canal and absorb their nutriment through their delicate wall. They are capable of executing wriggling movements. The cercariae, which develop in the interior of the sporocysts, make their escape through rents in the wall.

The cercaria comprises a body which is an undeveloped adult and a tail which is purely larval. They possess digestive, excretory, and genital systems and oral and ventral suckers. It is by these characters that the cercariae may be classified.

One of the most characteristic features of the Bilharzia cercariae is the presence of a tail which shows a terminal bifurcation. This feature is possessed by two divisions of distomes, the lophocerca and the furcocerca. Bilharzia belongs to the latter of these groups as it possesses a well developed ventral sucker.

The proof of actual penetration of the cercariae through the skin was furnished by suspending a young mouse in a test tube containing water full of cercariae for half an hour, and examining paraffin sections from the animal embedded whole. When the mouse was removed from the water only a few cercariae remained, and a large number of detached tails were found. The sections showed that the cercariae actually penetrated the skin, and did not enter the tissues by way of the hair follicles or pores. The warmth of the body seemed to be attractive to the cercariae, as very little evidence of penetration was obtained when a dead mouse was used.

After penetration of the definitive host there is no metamorphosis, development being simply a matter of growth and differentiation of organs and sexes. A plate gives illustrations of the various stages of development from the moment of penetration of the cercaria up to the complete development of the male and female, which requires a period of about two months.

LIFE-CYCLE OF A DIGENETIC TREMATODE.
[LEPER (R. T.).]

It is not yet certainly known by what path the parasite reaches the portal system, but it is definitely ascertained that all the cercariae do not reach the liver at the same time. It is probable that some pass direct into the blood stream, while others pass first through the lymphatic system.

- (31) RANSOM (B. H.) & HALL (M. C.). *The Life-History of Gongylonema scutatum.—Jl. of Parasitol.* 1915. Dec. Vol. 2. No. 2. pp. 80-86.

The authors' summary is as follows:—

"The eggs of *Gongylonema scutatum* present in the faeces of sheep and cattle infested with the adult parasite, hatch out when swallowed by insects of various species.

"The larvae thus released from the eggs, pass into the body cavity and reach the final larval stage in about a month. In this stage the larva is coiled into a spiral and is enclosed in a capsule about half a millimeter in diameter. The length of the fully developed larva is about 2 mm. and the oesophagus equals about two-thirds the body length. The mouth, elongated dorso-ventrally, is surrounded by a flange-like chitinous border.

"Sheep fed upon insects containing these larvae became infested with *Gongylonema*. A hog fed upon croton bugs artificially infested by feeding with eggs of *Gongylonema* from cattle failed to become infected. A mouse, rabbit, and guinea-pig fed with *Gongylonema* larvae from beetles found in sheep manure, or from croton bugs artificially infested by feeding *Gongylonema* eggs from cattle, also failed to become infected. Failure to produce infestation in these various animals indicates that the *Gongylonema* of sheep and cattle (*G. scutatum*) is not transmissible to hogs, mice, rabbits, or guinea-pigs.

"*Gongylonema* larvae have been found in various species of dung beetles collected from sheep manure, namely, *Aphodius femoralis*, *A. granarius*, *A. fumentarius*, *A. coloradensis*, *A. vittatus*, *Onthophagus hecate*, and *O. pennsylvanicus*. They have been developed in various species of *Aphodius* and in croton bugs (*Ectobia germanica*) by feeding the eggs of the *Gongylonema scutatum* from cattle. The feeding of eggs of *Gongylonema* from the gullet of a hog (presumably *G. pulchrum*) to croton bugs also resulted in the development of encysted larvae.

"Under natural conditions the usual intermediate hosts of *Gongylonema scutatum* are probably dung beetles of various species.

"The life history of *G. scutatum* is similar to that of *G. neoplasticum* of rats, mice, and other rodents, the intermediate stage of the latter having been found by Fibiger and Ditlevsen to develop in roaches (*Periplaneta americana*, *P. orientalis*, and *Ectobia germanica*) and in a beetle (*Tenebrio molitor*). It is also similar to that of another rat and mouse parasite, *Spiroptera obtusa*, whose intermediate host was found by Leuckart and Marchi to be the larva of a beetle (*Tenebrio molitor*)."

BITING FLIES, ETC.

- (32) RODHAIN (J.) & BEQUAERT (J.). *Sur quelques Oestrides du Congo.* [The Oestridae of the Congo.]—*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 687-695.

In this paper the authors revise in the light of recent discoveries the classification of the African Oestrinae which they published in 1913*. In addition to the introduction of the new genus *Kirkioestrus* (*Kirkia* Gedoelst), they have included the *Cephenomyia* Latr. and the *Pharyngomyia* (Schiner).

- (33) RODHAIN (J.) & BEQUAERT (J.). *Sur quelques Oestrides du Congo.* [Some Oestridae of the Congo.]—*Bull. Soc. Path. Exot.* 1915. Dec. Vol. 8. No. 10. pp. 765-778.

Four species of Oestridae have been discovered in elephants in the Belgian Congo. Two of these occur in the stomach, one in the oesophagus, and one in the sole of the foot.

The species found in the foot is *Neocuterebra squamosa* Grunberg, and it is found in the adipose tissue of the sole, or partly in the thickened dermal layer. This species is very scarce and all attempts to obtain the mature insect have failed.

The larvae are oval in shape and biconvex. They are very slightly fattened from above to below. There are neither intermediate zones nor lateral prominences. The two cephalic segments are fused, making 11 segments in all. Both surfaces show a number of regularly arranged rounded or toothed chitinous scales. The pseudocephalon is retracted into the third segment and provided with two small buccal hooks, and two antennary papillae. The anal segment is very small, and completely retracted into a deep depression in the preceding segment. The posterior stigmatic plates are oval and enclosed in a deep hollow in the anal segment.

The parasite varies in length from 17 to 21 mm. and from 8 to 11 in width.

The oesophageal parasite is very common and belongs to the species *Pharyngoglobus africanus* Brauer. It is found attached to the wall of the oesophagus close to the cardia. The authors have been able to obtain pupae in fresh faeces, and attention is drawn to the fact that the larvae mature in the oesophagus and are passed through the intestine and pupate in the soil.

In the third stage they measure from 25 to 29 mm. in length and from 10 to 11 in width. The body is slightly flatter on its ventral than on its dorsal face, and the posterior extremity is about the same width as the anterior. The antennal swellings are widely separated at their bases and each is furnished with three ocelliform projections. The anal segment is rounded posteriorly and the stigmatic cavity is very deep. The latter is open to the exterior through a small aperture bounded by two lips which are in contact. The pre-anal swelling is well developed, but shows no transverse groove. There are numerous

* *Rev. Zool. Africa.* Vol. 2. No. 2. p. 182.

rings of spines, but there are no groups on the ventral surface. There are complete rings of spines which are composed of alternating large and small ones.

The anterior stigmata are well developed and appear as thickened chitinous knobs. The posterior stigmatic plates are semilunar in outline and show numerous false apertures.

In the second stage the larvae are scarcely different from those in the third stage except for their smaller size.

The pupae which the authors have been able to obtain from larvae evacuated naturally measured about 15 mm. by 8 mm. When viewed from below their outline was practically oval. The dorsal surface was markedly convex and slightly swollen behind the middle point. The ventral surface was almost flat.

From 20 to 21 days were required for the development of the nymph.

In a previous communication the authors included these parasites with the *Cephenomyia*, *Pharyngomyia*, and *Aulacephala*, but having had the opportunity of examining specimens of the first two they are now of the opinion that they should be grouped with the *Calliphorinae*.

Gastric larvae appear to be very common in elephants, and the authors have found two distinct types, types so different that they are almost inclined to place them in two separate genera.

One of the parasites found, of which the authors have been able to obtain the hitherto undescribed perfect insect, appears to be *Cobboldia loxodontis* Brauer.

Details are given of the characteristics of the male and female imagines, and attention is drawn to the fact that though they closely resemble *Cobboldia elephantis* there are certain points of difference serving to distinguish them.

The larvae in the third stage measure from 20 to 22 mm. in length by about 8 mm. at the widest part. The five anterior rings gradually taper to the cephalic extremity, but the posterior rings are more constant in size, with the exception of the last which is far narrower than the immediately preceding one.

The body is biconvex and there are no intermediate zones on either surface. On each side there are three deep longitudinal grooves between which on each ring from the second to the eleventh there is an upper and a lower prominence. On the second, third, and fourth segment there is often a third smaller projection.

As in the case of *C. elephantis* Steel there are no conical lateral swellings on the seventh to the eleventh segments.

The posterior stigmatic plates are placed very close together on the upper surface of the anal cavity so that they are scarcely visible from the exterior. They are oval in shape.

On the dorsal surface spines are present along the anterior borders of the segments only. On the ventral surface the segments show an increasing number of rows of spines to the sixth and seventh segments where there are four rows, and posterior to this they decrease in number again. On the sides of the body fusiform intermediate areas from the third to the eighth segment show groups of spines. There are two or three rows of small spines on the anal segment above the stigmatic plates, and the lower lip of the orifice shows above the conical prominences two swellings crowded with spines.

The duration of nymphosis is 19 to 20 days. The pupa closely resembles that of *Cobboldia chrysidiiformis*, and differs only from it in details of the disposition of the spines, and the rather larger size.

Cobboldia chrysidiiformis n. sp.

Full details are given of the male and female flies, and special attention is drawn to the fact that this fly presents an appearance so different from the other members of the genus that the authors were inclined at first to make a new genus for it. They bear a striking resemblance to Chrysides family of the hymenoptera both in respect to their general form and their brilliant greenish-blue metallic lustre.

The larvae in the third stage are of a dirty white colour and measure from 14 to 15 mm. in length by about half that at the widest part.

On the lateral swellings from the eighth to the eleventh segment there are conical papilla-like projections, and on the seventh segment there may be a very small projection corresponding with these.

The two segments of the pseudo-cephalon resemble those of *C. loxodontis*, and, as in that parasite, the anal segment carries three pairs of conical papillae. The general arrangement of the spines is very similar to that of *C. loxodontis*, but the spines are far less numerous.

The colour of the pupae is a glistening brownish-black. The anal segment is completely retracted into the preceding one. The anterior stigmata appear as two brownish-yellow swellings mounted on a short peduncle. The swollen extremity is surrounded by a complete circle of twelve small papillae.

The pupae measure from 13 to 15 mm. in length by 5 in width.

The classification of the genus *Cobboldia* is discussed.

- (34) JOYEUX (Ch.). Sur quelques Arthropodes récoltés en Haute-Guinée française. [Some Arthropods collected in Upper French Guinea.]—*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 656-659.

The larvae of *Amblyomma variegatum* are very numerous from November to February, and they attach themselves to man and animals. They commence to drop off at about the 12th hour, and continue to do so until the third day. The nymphs also attach themselves to man but to nothing like the same extent. The author has seen only one clear case of parasitism with the adults.

Dermanyssus gallinae and *D. hirudinis* are both common.

Hippobosca maculata Leach is common, and bites all species of domesticated animals, but the author has never observed it to bite man. The whitish pupa of this fly becomes black within 24 hours and hatching occurs in from 23 to 30 days.

Along the banks of the Niger and its tributaries the author has found both *G. morsitans* and *G. palpalis* in the proportion of two of the former to 52 of the latter.

The following mosquitoes have been obtained:—*Culiciomyia nebulosa*, *Culex duttoni*, *Pyretophorus costalis*, *Myzomyia funesta*, *Cyathomyia fusca*, *Stegomyia calopus*, *Toxorhynchites brevipalpis*.

Myiasis has been observed once in the human subject and seven times in animals, the latter cases being due to *Chrysomyia megacephala*. The female of this species lays about 90 eggs on the skin, and after an

interval of 18 to 24 hours, the larvae penetrate into the subcutaneous connective tissue and there complete their development. Necrosis of the skin results, and the adult larva drops to the ground, where it pupates.

In addition to the bovine animals already recorded by ROVERE as being attacked by this fly, the author has observed two cases in horses. The usual position of the lesions in cattle is about the mammary gland, and in the male about the scrotum, but the author has seen them in wounds of the dewlap of a zebu, and the base of the horn in an ox. In the horse the lesions are generally around the fetlock or near the frog.

Cordylobia anthropophaga is frequently a parasite of dogs and monkeys.

In one instance the author found a very severe infestation with *Gastrophilus nasalis* in the duodenum of a mule.

(35) NUTTALL (G. H. F.). Ticks of the Belgian Congo and the Diseases they convey.—*Bull. Entom. Research*. 1916. Feb. Vol. 6. No. 4. pp. 313-352. With 48 text-figs.

In this paper the following subjects are dealt with: The classification of ticks, together with a short illustrated account of the species occurring in the Congo; The general biology of ticks; The special biology of the Congo ticks and their relation to disease. The concluding pages give information on the following points: How to collect ticks and what to observe; How to raise ticks; and an Index to the Congo ticks and their hosts.

The following tabular statement regarding the ticks is included:—

INDEX TO CONGO TICKS AND THEIR HOSTS.

	Hosts.†
<i>Amblyomma cohaerens</i> , Dönitz 1909 ..	cattle, buffalo.
* " <i>hebraeum</i> , Koch 1844 ..	cattle, sheep, goat, antelope.
" <i>marmoreum</i> , Koch 1844 ..	rhinoceros, Genetta, Chelonia, python.
" <i>pomposum</i> , Dönitz 1909 ..	cattle, mule, antelope.
" <i>splendidum</i> , Giebel 1877 ..	cattle, buffalo.
" <i>tholloni</i> , Neumann 1899 ..	elephant, horse, antelope.
" <i>trimaculatum</i> , Neumann 1908 ..	lizards.
" <i>variegatum</i> (Fabricius 1794)	cattle, sheep, rhinoceros.
<i>Aponomma exornatum</i> , Koch 1844 ..	reptiles.
" <i>laeve</i> , Neumann 1899 ..	reptiles.
* <i>Boophilus decoloratus</i> (Koch 1844) ..	cattle, sheep, goat.
<i>Dermacentor circumguttatus</i> , Neumann 1897 ..	elephant.
" <i>rhinocerotis</i> (de Geer 1778)	rhinoceros.
* <i>Haemaphysalis leachi</i> (Audouin 1827) ..	<i>Carnivora</i> , cattle, sheep, goat, horse.
" <i>parvata</i> , Neumann 1905 ..	cattle, goat, sheep, buffalo, antelope, dog, Potamochoerus.
‡ <i>Hyalomma aegyptium</i> (Linnaeus 1746) ..	cattle, sheep, etc., dog.

* See note at end of Index.

INDEX TO CONGO TICKS—cont.

		Hosts.†
<i>Ixodes rausus</i> , Neumann 1899 .. .		cattle, dog, leopard, Hyrax.
„ <i>rubicundus</i> var. <i>limbatus</i> , Neu- mann 1908 .. .		sheep, goat.
* <i>Ornithodoros moubata</i> (Murray 1877) ..		man.
<i>Rhipicentor bicornis</i> , Nuttall and War- burton 1908 .. .		horse, goat.
* <i>Rhipicephalus appendiculatus</i> , Neumann 1901 .. .		cattle, sheep, goat, horse.
* „ <i>capensis</i> , Koch 1844 ..		cattle, antelope, pig.
* „ <i>evertsi</i> , Neumann 1897 ..		cattle, horse.
„ <i>evertsi</i> var. <i>albigeniculatus</i> , Warburton 1915 (n. var.)		cattle.
„ <i>falcatus</i> , Neumann 1908..		cattle, goat, dog.
„ <i>lunulatus</i> , Neumann 1907		cattle, sheep, goat, antelope, dog.
* „ <i>sanguineus</i> (Latreille 1804)		dog, sheep, goat.
* „ <i>simus</i> , Koch 1844 ..		cattle.
„ <i>supertritus</i> , Neumann 1907		cattle.
„ <i>tricuspidis</i> , Dönnitz 1906 ..		rabbit.

* Denotes species which convey diseases and whose life-histories are described in the text.

† Names in italics are those of hosts from which we have received most specimens.

‡ Life-history described in the text.

- (36) BISHOPP (F. C.) & LAAKE (E. W.). A Preliminary Statement regarding Wool Maggots of Sheep in the United States.—*Jl. Economic Entomol.* 1915. Vol. 8. No. 5. pp. 466-474.

As yet the species of flies responsible for this injury to the wool in the United States have not been definitely ascertained, but it is believed that *Lucilia sericata* and *L. caesar* are responsible, at least in part.

In parts of Texas two types of injury to the wool are observed. The first of these occurs in ewes just after lambing, which takes place in March and April. In this case the infestation is confined to the rump. In the other type of injury the process starts about the base of the horns in rams, the infestation being favoured by the presence of small wounds in this situation, which are caused by fighting.

Formerly the flies appeared to blow only soiled wool, but during recent years they appear to have acquired the habit of attacking all classes of sheep, clean or otherwise.

In Texas the authors have found that the common black blow-fly is responsible for these attacks during the spring.

The infestations which occur in Texas during the late summer are probably due to *L. sericata*.

Phormia regina, the black blow-fly, is found throughout the United States, but its seasonal distribution varies according to the temperature. In the southern parts it is most plentiful in the spring, but is active through the winter except for a few days during the cold period. It disappears during the hot weather. In the more northern parts the season is during the summer.

The fly breeds almost exclusively in animal matter, especially if it is in a decaying condition, and it appears to be probable that it is the odour of soiled wool, particularly if blood be present, that attracts the flies to living sheep. It is observed that the flies do not feed on the droppings of herbivorous animals.

Hatching requires from 24 hours to 4 days under experimental conditions, but it is probable that the period is shorter with eggs deposited upon living animals. The larvae complete their development in from 4 to 76 days, and before pupation they generally penetrate into the ground to a depth of three or four inches. The pupal stage last for from three days to a month. The periods are shorter as the temperature rises, but excessively high temperatures appear to hinder breeding.

When caged without food adults have lived from two to eight days. With animal food they have lived for one to three months.

Lucilia sericata is observed throughout the Southern States except during the coldest periods. Reproduction does not take place during the winter even in the extreme south, the winter being passed in the larval or pupal stage in the ground. Attempts to keep adults through the winter in cages have not been successful.

While *P. regina* is found on the ranges, *L. sericata* is far more closely associated with human habitations. Garbage of all sorts, and especially damaged fruit, is a favourite food of the adult, but the authors have not succeeded in rearing larvae or even obtaining deposits of eggs on substances other than animal matter.

The adult does not live for more than three days in captivity when starved, and when fed the period of life does not exceed six weeks.

The interval between emergence of the adults to the commencement of egg laying varied from 4 to 21 days. As a rule rather less than 24 hours is the period required for hatching.

As measures for the repression of the condition it is suggested that carcasses should be burnt, or if that be impracticable they should be buried. If they can be buried before they become blown a few inches of soil is sufficient to cover them, but if they are already blown they should be buried to a depth of two feet to prevent the flies from emerging.

The lambing should be done if practicable during the winter, and the flock should be divided into small lots and carefully watched. Every effort should be made to prevent scouring. Hornless breeds should be encouraged.

A hymenopterous parasite, probably *Nasonia brevicornis*, has been found to breed freely in the puparia of a number of carrion flies, and as the period required for the development is short and the reproductive capacity of this parasite is great, it may be looked upon as an important check to fly breeding.

MISCELLANEOUS.

- (37) WEIDMAN (F. D.). An Arachnid (*Pneumotuber macaci* Landois and Hoepke?). Parasite in the Lungs of a Monkey (*Macacus rhesus*).—*Jl. Comp. Path. & Therap.* 1915. Dec. Vol. 28. No. 4. pp. 326-330. With 1 text-fig.

In the lungs of a monkey dying from subacute enteritis the author found a number of nodules varying in size from 2 to 5 mm. in diameter. The smaller ones were firm, but the larger ones showed soft centres with indurated edges. In the fresh state they were pink or grey and

contained grey granular material. Under the microscope arachnoids were found in the centre of them. Sections showed that the centres of the lesions were composed of necrotic material surrounded by an ill-defined wall composed of mononuclears and fibroblasts.

From one of these lesions nine parasites were obtained. Eight of these appeared to be females, some of which were ovigerous. Embryos were visible within the eggs.

The full-grown parasites measured about 0·75 mm. in length. The legs terminated in claws.

A full description of the parasite is withheld until the author has had the opportunity of consulting the descriptions given by other authors of similar parasites found in the same situation.

- (38) WEIDMAN (F. D.). *Pneumonyssus foxi*, nov. sp. An Arachnid Parasite in the Lung of a Monkey (*Macacus rhesus*).—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1. pp. 37–45. With 1 plate comprising 10 figs.

For a short account of the occurrence of this parasite see above.

The females measured rather less than 1 mm. in length by nearly 0·5 mm. in width at the widest part, viz., just behind the posterior pair of legs. None of the internal organs could be made out, but in a few females an egg could be seen, and in some instances the outlines of a folded embryo in the interior of it.

The head is continuous with the body both dorsally and ventrally. There are no eyes. The rostrum projects slightly, is triangular in shape with a rounded apex, and shows on its dorsal surface a wide groove. The hypostome is quadrilateral and shows a slight median anterior marginal peak. A shallow furrow runs along this in which are placed 8 to 13 blunt teeth directed downwards and forwards. The mouth parts are retracted. Full details are given regarding the structure of the legs.

The first pair of legs has two arched dorsal claws, the extremities overhang or touch a pointed ventral projection. The second pair terminates in a short broad caroncle with two strong claws attached to its dorsum internally. The third pair terminates in a manner exactly similar to the second. The hooked caroncles and the hooks on the fourth pair of legs are more slender and elongated than on the preceding pairs.

The cuticle is soft and has an appearance resembling very fine morocco leather; this is especially marked in certain areas.

The vulva lies ventrally in the middle of a transverse ridge joining the fourth coxae. It is longitudinal, fissural, and short, and is flanked by narrow plates. It appears to be continuous above with the posterior angle of a laterally elongated triangular opening. The intestines are indicated by two tortuous black lines which lie longitudinally close to the dorsal cuticle.

A single parasite judged to be a male from its smaller size was discovered. This parasite measured 0·55 by 0·25 mm. There was no vulval orifice, but a special anterior ventral orifice. Otherwise it was very similar in its general features to the females.

The genital orifice is a small circular orifice immediately behind the hypostome. From this a tube leads posteriorly for some distance just under the ventral cuticle.

A larval form was found which appeared to have escaped from a female, close to which it was lying, as a result of rupture of the latter during manipulation. This parasite possessed only six pairs of legs, and was about the same size as the male above referred to.

The parasite appears to be different from the four species occurring in the same situation already described. The classification of the parasite in the genus *Pneumonyssus* is only tentative, and it is pointed out that the position of the genital orifice of the male places the parasite close to, if not in, the Gamasidae.

(39) HEALY (D. J.) & GOTTFRIED (E. J.). A Filterable Organism isolated from the Tissues of Cholera Hogs.—*Jl. Infect. Dis.* 1916. Jan. Vol. 18. No. 1. pp. 124-127. With 1 plate.

The work reported in the present paper arose out of the discovery by HEALY and SMITH that an extract of mesenteric glands could be used as antigen in complement-fixation reactions. The evidence indicated that the antigen was specific. It is noted that in the original preparation the glands had to remain for at least eight days at 4° C. to allow the antigen to develop, and also that passage of the preparation through a Pasteur-Chamberland F filter removed it. The preparation of glands referred to was originally made in an attempt to isolate a filterable virus from them. Since in these experiments the extract was always passed through the filter immediately after the glands had been ground up with sand and the results were invariably negative, it occurred to Healy that the reason might be that the organisms were present in too small numbers, and that if the extract were allowed to stand at 4° C. to allow of a possible multiplication the subsequent filtration might not completely stop the organism.

The mesenteric glands of some infected pigs were dissected out with sterile precautions and ground up with sand. They then had added to them ten times their weight of 1 per cent. neutral glucose beef broth and were left at 4° C. for five days. During this period active fermentation occurred. The liquid was then passed through a reburnt, tested, sterile F filter, the period required being 40 minutes. The brilliant filtrate was divided between two Erlenmeyer flasks. One of these was placed in a Novy jar and the oxygen exhausted. The other was sealed with paraffin and placed in the air. Both flasks were kept at 4° C.

No growth developed in the flask in the Novy jar. In the other there was visible growth from the fourth day, which continued for about two weeks. This growth took the form of a very fine sediment which was easily disturbed by shaking. The flask which had originally been placed in the Novy jar when sealed with paraffin and placed in the air developed an exactly similar growth from the 7th day. This experiment was repeated three times with the same results.

The authors have found that the organism grows best at 37° C. in extract of mesenteric glands to which 5 per cent. glycerin has been added. Under these conditions there is visible growth after 24 hours and the maximum is reached in about three days. No growth takes place in the absence of oxygen, nor in any of the ordinary culture media. No subcultures have been obtained.

The original extract of the glands is slightly acid in reaction, and this acidity increases with incubation. No growth takes place if the medium be neutralised.

In hanging drop preparations it is seen that the organism is non-motile. It occurs in very small clumps showing many minute bright points. Individual organisms cannot be clearly distinguished.

Ordinary aniline dyes do not give good results, but under proper conditions good results are given by Giemsa.

A three-day culture grown at 37° C. was centrifuged and smears made of the deposit. These were allowed to become dry in the air, and were then fixed in methyl alcohol for an hour, rinsed in distilled water and again air-dried. They were stained with a warm solution of Giemsa containing 50 drops to 50 cc. and accurately neutralised. After staining the preparations were washed in distilled water, air-dried and mounted in xylol balsam. In such a preparation the organisms are clearly seen as minute lilac coloured bodies embedded in a paler lilac coloured material which in the fresh preparations had a gelatinous appearance.

The organism appears to be either a coccus or a very short bacillus about 0·2-0·3 microns in diameter.

- (40) GRAHAM (R.) & HIMMELBERGER (L. R.). The Value of Virulent Salt Solution in the Production of Antihog-cholera Serum by the Intravenous Method.—*Jl. Infect. Dis.* 1916. Jan. Vol. 18. No. 1. pp. 118-123.

The authors have taken up the work first suggested by CRAIG and ROBBINS of attempting to increase the yield of virus from pigs by injecting normal salt solution into the peritoneal cavity and leaving it there for some hours before slaughter. They have however used the virulent salt solution thus obtained for intravenous injection instead of subcutaneous injection.

They have found that the best results are obtained when 25 cc. per pound body weight of 0·9 per cent. salt solution are injected into the peritoneum five or six hours prior to slaughter, the salt solution being withdrawn with aseptic precautions afterwards.

The amount of blood obtained when this plan is adopted is from 10 to 20 per cent. greater than ordinarily, and from 40 to 70 per cent. of the salt solution injected is recovered.

Salt virus and blood virus were first used for hyperimmunisation in mixtures containing respectively 1, 2, and 3 parts of blood to 3, 2, and 1 part of salt virus. The dose of the mixture was 7 cc. per pound weight.

The sera of these three animals proved to be protective.

Subsequently a number of other mixtures were used, but in general the proportion of blood virus to salt virus was 60 to 40, the dose being 7 cc. per pound body weight. The serum obtained by this procedure was efficient for the protection of pigs against 2 cc. of virus.

It is not contended that the salt virus is as virulent as the blood virus, but it is shown that the mixture is effective for the production of serum, and it is suggested that if a higher concentration of salt solution were introduced into the peritoneal cavity a higher degree of virulence would be acquired by it.

On the basis that a virus pig yields about 10 to 15 cc. of blood per pound body weight, the injection of the salt solution into the peritoneum increases the yield by from 200 to 500 cc. Including the blood virus and the salt virus the total yield of virus is increased from 75 to 80 per cent.

- (41) RAILLIET (A.) & HENRY (A.). *Le parasite de la dermite granuleuse des équidés.* [The Parasite of Granular Dermatitis in Equines.]—*Bull. Soc. Path. Exot.* 1915. Nov. Vol. 8. No. 9. pp. 695-704. With 3 text-figs.

The authors deal at some length with the evidence upon which they base the conclusion that the parasite present in summer sores does not belong to the genus *Filaria*, but to the *Spiroptera*, and that it should in reality be classed in the genus *Habronema*.

With regard to the manner in which the embryos gain access to the subcutaneous tissue, the authors are inclined to think that the embryos are passed out from the stomach and reach the exterior with the faeces, and that they penetrate the skin in the same manner as the larvae of the ankylostomes, and that the rubbing due to the irritation thus set up is responsible for the production of the sores.

- (42) CARPANO (M.). *Sulla virulenza del sangue degli animali infetti di peste bovini.* [The Infectivity of the Blood of Animals infected with Rinderpest.]—*La Clinica Veterinaria.* 1915. Dec. 15. Vol. 38. No. 23. pp. 901-915.

As a result of some observations carried out in Eritrea, the author arrives at the conclusion that the blood in cases of rinderpest may not be infective during the stage of the disease that is characterised by symptoms indicating gastro-intestinal disturbance, nor at the time of death.

- (43) ARMFIELD (J. M.). *Some Important Cattle Diseases in North-West Rhodesia not mentioned in Text-Books.*—*Vet. Jl.* 1915. Dec. Vol. 71. No. 486. pp. 583-584.

The author records the occurrence of a disease somewhat resembling three-day sickness, but differing from that disease in that the animals showed stiffness in the hind limbs for many weeks, and became very emaciated ; and also a condition which he terms "posterior paralysis" which has caused losses among imported bulls. The latter disease has only been observed during the last two years. Nothing is known regarding the cause of either of these conditions. In some cases the disease is acute and in others chronic. The author has seen a case terminate fatally in three weeks. Although the disease has been most frequently observed in imported animals, and in cross-breds, cases have also been seen in native animals.

- (44) BEVAN (Ll. E. W.). *A Simple Method of obtaining Serum for the Agglutination Test from Cattle Suspected to be suffering from Contagious Abortion.*—*Jl. Comp. Path. & Therap.* 1915. Dec. Vol. 28. No. 4. pp. 277-280. With 2 text-figs.

Owing to the difficulties associated with the obtaining of sterile blood under the conditions prevailing on the veldt, a number of tests

were carried out with the object of ascertaining whether any antiseptic mixture could be added to blood to prevent putrefactive changes occurring in it. It was found that a 3 per cent. solution of boracic acid in normal salt solution, when added to the blood in the proportion of one part to five, was quite efficient for this purpose, and that such addition did not render the serum unsuitable for the test.

For the collection of the blood tubes were prepared in the following way :—Pieces of glass tubing three inches long and with a bore of 4 mm. and an external diameter of 6 mm. were drawn out at each end, so that the tapering portions did not exceed one inch in length, and the ends were clean cut. If the tubing was larger than this the capillary attraction was not sufficiently great, and the blood tended to run into the tube and close the opposite end. If the point were too finely tapered the blood tended to coagulate in the point.

In taking the blood the best method was found to be as follows :—

A cut was made on the lower margin of one of the ears, preferably the left, so that the blood flowed too freely to coagulate.

A quantity of the boracic solution was drawn into the pipette the point of which was then applied to the drop of blood on the edge of the ear, the tube being held horizontally.

When the blood has been collected the ends of the tubes are sealed in the flame of a spirit lamp, or if that be not available they may be plugged with sealing wax.

By adopting this method it has been found possible to test every sample sent in to the laboratory, whereas when the blood was withdrawn from the jugular 50 per cent. of the samples had to be rejected owing to contaminations having rendered the blood quite unsuitable for the test.

(45) BOERNER (F.) Jr. Natural Haemolysins in Normal Horse Serum.—
Jl. Infect. Dis. 1915. Nov. Vol. 17. No. 3. pp. 497-499.

Conclusions :—

" Of 200 sera examined for antisheep haemolysin, 1·5 per cent. were found capable of producing complete destruction of these cells in the amount of 0·4 cc.

" Horse serum was found to possess the property of dissolving the red cells of the dog without the aid of complement.

" Native haemolysins for the cells of the guinea-pig, hog, goat, cat, white mouse, rabbit, chicken, and man were not found."

(46) KOLMER (J. A.), TRIST (M. E.) & HEIST (G. D.). Complement Fixation in Intestinal Parasitism of Dogs.—*Jl. Infect. Dis.* 1916. Jan. Vol. 18. No. 1. pp. 88-105.

The authors were induced to carry out the investigations described in this paper by the fact that in superficial diseased conditions such as ringworm positive complement fixation tests can be obtained. Dogs were selected on account of the abundance of material available, and the possibility of controlling the results by post-mortem examination.

As antigens extracts in salt solution and alcohol were prepared from various worms that are frequent inhabitants of the intestine of the dog. In addition to these an extract of *Strongylus gigas* was also used.

The salt solution extracts were prepared by grinding up 4 grams of washed parasites with sand and powdered glass and suspending the resulting material in 100 cc. of salt solution containing 0·5 per cent. carbolic acid. The mixture was shaken for 24 hours in a shaker, incubated for several days at 37° C., and then filtered and stored. These extracts were found to be rather variable and to require titration before every experiment, as the anti-complementary units present varied considerably.

The alcoholic extracts were made with absolute alcohol in the same manner, except that the incubation was continued for a longer time.

One of the difficulties encountered in the course of the observations was the frequent occurrence of non-specific complement fixation. The sera were therefore generally used in both the active and inactivated state. The dose was generally about 0·1 cc.

Another difficulty was the impossibility of ascertaining the duration of the infestation, and the difficulty of excluding infestations on the basis of a single or multiple negative examination of the faeces. It is unsettled whether antibodies persist in the body after the expulsion of the parasites.

Tabular statements of the tests carried out with various extracts are given, the results of which are also summarised.

Tests were made with serum from 172 dogs, but in 62 instances proper examination of the faeces could not be carried out.

From these the following information may be gained :—

Of 36 dogs, the sera of 10 gave positive results with salt solution extracts of *Ascaris canis*. The sera of only two of these dogs gave positive results with alcoholic extracts of the same parasite. Positive results were obtained with alcoholic extracts of *Ascaris lumbricoides* in the case of 11 dogs, and of these five had given negative results with the two extracts of *Ascaris canis*.

In five dogs which were infested with *T. serrata* three yielded positive results with the salt solution antigen, and four with the alcoholic extract antigen. None of these reacted to an alcoholic antigen prepared from *T. saginata*, but four dogs infested with *Dipylidium caninum* gave positive results.

Thirty-four dogs infested with *Trichocephalus dispar* were tested with salt solution extracts, but the result was negative in each case. Sufficient parasites were not available for the preparation of an alcoholic extract.

In a considerable number of cases positive results were obtained with sera from dogs in whose faeces no ova could be discovered. The tabular statement of these tests does not include those in which the serum control tube showed an anticomplementary state of the serum.

In a previous paper the authors have shown that inactivating normal rabbit and dog serum by heating to 56° C. for half an hour greatly increases the antilytic activity and the percentage of non-specific complement fixations. But heating to 62° C. tends to remove a large amount of the non-specific antilytic complement fixing substances without materially decreasing the amount of antibody.

In general it appeared that a higher percentage of positive results was obtained when alcoholic extracts were used than when salt solution extracts were employed, and that tapeworms were more likely to give rise to antibodies than round worms. It would further appear that the antibodies are not highly specific.

Experiments in which descending doses of serum were used showed that the tapeworms and the round worms produced antibodies almost specific for themselves, but not highly specific for different worms belonging to these groups.

Very similar results were obtained when rabbits were immunised with extracts of the parasites, and their sera tested with homologous and heterologous antigens.

- (47) SARTORY (A.). *Présence du Sporotrichum beurmanni de Beurm. et Goug. sur un épi de blé.* [The Presence of *Sporotrichum beurmanni* on an Ear of Corn.]—*C. R. Soc. Biol.* 1915. Dec. 31. Vol. 78. No. 20. pp. 740-742.

The author cultivated the parasite from an ear of corn which was thought to be infected with rust.

Cultures were obtained in the first instance on simple agar and on Sabouraud's peptonised glucose agar. A mycelium composed of segmented filaments 2 microns in diameter developed in a week. Conidia were present along the sides and at the extremities of the filaments and the side branches. The spores were pyriform and attached to the filaments by very slender pedicles. They measured from 3 to 6 microns in length and from 2 to 4 in breadth. When mature they were oval in shape.

The colonies on Sabouraud's medium presented the typical wrinkled appearance on the surface, and gradually changed in colour from white to coffee coloured and then to a brown black.

The parasite was cultivated on glycerinised potato and carrot, the latter acidified with 3 per mille tartaric acid, peptone agar, broth, glucose broth, glucose gelatin, coagulated serum, milk, starch, white of egg, haemoglobin, urea, ammoniacal salts, and peptone water.

There was no transformation of starch into dextrin, no liquefaction of the egg-white, no fermentation of the urea, nor alteration in nitrates and nitrites. Gelatin was liquefied, and there was no formation of indol. Glucose, galactose, levulose, saccharose, and maltose were fermented, but lactose, dulcite, and mannite were not.

Passage of the parasite through the rat exalted its virulence and eventually the organism produced a rapidly fatal septicaemia. Agglutinins and antibodies could be detected in the blood, and positive complement fixation results were obtained.

The author refers to GOUGEROT's discovery of the parasite on plants in the Alps.

- (48) MARIN & HENRY. *Le charbon bactérien dans le région de Constantine.* [Anthrax in the Neighbourhood of Constantine.]—*Bull. Soc. Path. Exot.* 1916. Feb. Vol. 9. No. 2. pp. 79-81.

In this short paper the authors draw attention to the occurrence of atypical cases of anthrax among bovine animals. In some instances outbreaks of the disease have occurred, but other isolated cases have

been encountered. In some of these cases a diagnosis would not have been made unless microscopic examination had been resorted to on account of the absence of symptoms and the usual lesions. Cases have come under observation in which the spleen was practically normal in size and colour, and in others the blood appeared to be partially coagulated. It was only after the carcase had been skinned that blood-stained exudates were found in the subcutaneous tissue and between the muscles. In two animals the only lesions were haemorrhagic mediastinal glands.

Diagnosis has been established in these cases by microscopic examination and by cultivation.

These facts emphasise the importance of very careful inspection of meat.

The authors have not observed any cases of the disease in animals other than of the bovine species, and the majority of cases have occurred in animals imported from France, or among the progeny of such animals crossed with local breeds. The indigenous cattle are not immune.

In three outbreaks protective serum obtained from the Pasteur Institute at Paris has been used with exceedingly good results. During 1915 vaccination was employed on a large scale and a few cases have been observed among unvaccinated animals only.

In no case has the vaccination been responsible for death.

(49) CONREUR (Charles). *Cachexia ossea dos equideos—Cachexia verminosa dos equideos—Cylicostomose.* (Vulgarmente, no Brasil : Cara inchada). [Osseous Cachexia of Horses—Verminous Cachexia of Horses—Cylicostomosis. Vulgarly called in Brazil, Swollen Face.]—*Arch. Brasileiros de Med.* 1915. Aug. Vol. 5. No. 8. pp. 323-348.

By the above names the author distinguishes a disease of horses which is in his opinion due to the presence of the intestinal worm, *Cylicostomum tetricanthum*. It occurs throughout Brazil from north to south, where it chiefly affects young horses imported from Europe, especially thoroughbreds. It has been already described by GERMAIN, CAROUGEAU and others as occurring in Tonkin, Madagascar and other tropical localities, and its presence in Brazil was first noted by LUTZ in 1910. [The author gives no references to the literature of the subject.]

The author having had the opportunity of making numerous post-mortems on horses dead of this disease has found in all of them the intestinal worm already mentioned, and therefore attributes the symptoms to its presence. The disease is common in racing stables near Rio de Janeiro, where young imported thoroughbreds are trained. The ova of the worm can be found in the faeces, and the manure from these stables is often spread on grass land, which is then mowed for hay or green fodder. The disease is thus propagated. The animals present a gradually increasing cachexia followed by fragility of the bones, which results in numerous spontaneous fractures necessitating slaughter. In the final stages the maxillary bones are attacked by a rarefying osteoporosis, accompanied by swelling, to which the vulgar name of "Swollen face" is applied. The author scorns the idea that

this cachexia is in any way due to malnutrition, or to deficiency of lime in the soil, because cattle and sheep pastured on the same ground are totally exempt from the disease, and moreover do not present signs of rickets.

Regarding the disease as due to the action of a toxin on the haemo-poietic system, the author recommends the internal use of arsenical preparations, and accordingly, has tried cacodylate of sodium, arrhenal, atoxyl and salvarsan in doses ranging from 60 to 120 centigrammes given intravenously two or three times a week, for from four to eight consecutive weeks. As a vermifuge, the author recommends for young horses from one to two years old the following bolus :—

Thymol	6 grammes.
Santonin	50 centigrammes.
Aloes	6 grammes.
Hard soap, sufficient to form a bolus.	
S. One to be given every two to four days.	

For a horse from two to three years of age, the dose should be increased by 50 per cent., and for one over three years, by 100 per cent. The dose should be repeated till three or four have been given.

The author believes that he has obtained excellent results from this treatment with horses in the early stages of the malady, some of them having been able to win races within two months of the cessation of treatment. As a preventative, the burning of all manure from infected horses, or its burial in cultivated soil, is advised, instead of allowing it to be spread on grass land.*

REPORTS.

- (50) PUNJAB. Annual Report of the Camel Specialist. [Cross (H. E.).] 21 pp. 1915. Lahore: Superintendent, Government Printing. [Price 2d.]

In connection with the question as to whether other animals are susceptible to camel surra only a small number of experiments could be carried out, on account of pressure of other work. The results appeared to indicate that dogs are susceptible, but goats insusceptible. One experiment was carried out in which the camel strain was passed through a pony and then again inoculated into a camel. This single result appeared to indicate that passage through a pony attenuates the virus for the camel.

Treatment.—Sixty-eight animals were treated by the "arsenic alone" method or by the "arsenic and soamin" method. Of these 54 were reported as cured and 14 died.

Experiments in the treatment of the disease have been or are being carried out. Iodine, carbolic acid, sodium bicarbonate, potassium permanganate and borax have been tried, but no good results have been obtained with any of them.

With a view to protecting camels from the bites of blood-sucking flies a number of investigations were made into the properties possessed by various substances for this purpose.

* Summarised by Dr. J. B. NIAS.

The conclusion arrived at was that the only emulsion that was of any use was one of chirpine oil in the proportion of 20 to 40 ounces to a gallon of water. The amount sprayed on each camel should be about four pints. Even this emulsion was not of any great value from a practical point of view as it was efficient for only about three hours. If the emulsion was made with 80 ounces of the oil to two gallons it was found that blistering of the skin resulted.

Inspection of castrated camels indicated that those castrated at seven years and upwards were much better animals than those operated upon earlier.

Experiments showed that the best purgative for camels is magnesium sulphate, the dose being from $1\frac{1}{2}$ to 2 pounds. Next in order with the doses are: Kamala, 8 ozs.; croton oil, $3\frac{1}{2}$ drachms; aloes, $3\frac{1}{2}$ ozs. of solution; gamboge, 3 ozs.; and linseed oil, 4 pints. Two grain doses of eserine and pilocarpine given subcutaneously give satisfactory results.

(51) GOLD COAST. Annual Report of the Veterinary Department. 1914.

[BEAL (W. P. B.)] 18 pp. With a map, 3 plates & 1 chart. 1915.
London: Waterlow & Sons, Ltd.

Trypanosomiasis.—The disease caused in equines by *T. cazelboui* is less serious than that due to *T. pecaudi*. In many cases of infection by the former parasite there are no clinical symptoms save dullness and elevation of temperature. In the disease produced by *T. pecaudi* there is swelling along the belly and oedema of the sheath and testicles. Filling of the legs and enlargement of the submaxillary glands are more marked in cases of *pecaudi* infection.

In the case of cattle similar effects are seen, the *cazelboui* infection being far less severe than the infection with *T. pecaudi*. It is said that cattle under good conditions infected with the former parasite may show no evidence of ill health.

Beal has come to the conclusion that *T. nanum* is identical with the trypanosome which he refers to as *T. cazelboui*.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 3, No. 4, pp. 163-164.]

Leishmaniasis.

- (52) ARAVANDINOS (A.). Contribution à l'historique de la leishmaniose interne. [The History of Internal Leishmaniasis.]—*Bull. Soc. Path. Exot.*, 1916. Jan. Vol. 9. No. 1, pp. 10-18.
- (53) LOW (G. C.). A Case of Oriental Sore treated by Antimonium tartaratum (Tartar Emetic) locally.—*Jl. Trop. Med. & Hyg.*, 1915. Nov. 15. Vol. 18. No. 22, pp. 258-260.

Spirochaetosis.

- (54) LURIE (G. A.). Notes on Castellani's "Broncho-Spirochaetosis" with Report of a Case.—*Jl. Trop. Med. & Hyg.*, 1915. Dec. 1. Vol. 18. No. 23, pp. 269-271. With 1 text-fig.

Trypanosomiasis.

- (55) GREGGIO Rd. S. J. (P. G.). La Trypanose humaine et la Natalité infantile dans la région de Kisantu (Moyen Congo Belge).—Influence du traitement atoxylé. [Human Trypanosomiasis and the Birth-rate in the Kisantu District, Middle Belgian Congo.—The Effects of the Atoxyl Treatment].—*Bull. Soc. Path. Exot.*, 1915. Dec. Vol. 8. No. 10, pp. 752-764.

Biting Flies and Ticks.

- (56) BISHOPP (F. C.). Flies which cause Myiasis in Man and Animals—Some Aspects of the Problem.—*Jl. Econom. Entomol.*, 1915. June. Vol. 8. No. 3, pp. 317-329.
- (57) CHIDESTER (F. E.). Sarcophagid Larvae from the Painted Turtle.—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1. pp. 48-49. With 2 text-figs.
- (58) CHRISTOPHERS (S. R.). The Pilotaxy of Anopheles.—*Indian Jl. Med. Research*, 1915. Oct. Vol. 3. No. 2, pp. 362-370. With 1 plate.
- (59) CHRISTOPHERS (S. R.). The Male Genitalia of Anopheles.—*Indian Jl. Med. Research*, 1915. Oct. Vol. 3. No. 2, pp. 371-394. With 6 plates comprising 36 figs.
- (60) EDWARDS (F. W.). Eight New Mosquitos in the British Museum Collection.—*Bull. Entom. Research*, 1916. Feb. Vol. 6. No. 4, pp. 357-364. With 5 text-figs.
- (61) KNAB (F.). Some New Neotropical Simuliidae.—*Bull. Entom. Research*. 1915. Dec. Vol. 6. No. 3, pp. 279-282.
- (62) LAMBORN (W. A.). Second Report on Glossina Investigations in Nyasaland.—*Bull. Entom. Research*, 1915. Dec. Vol. 6. No. 3, pp. 249-265. With 3 plates comprising 6 figs.
- (63) LLOYD (L.). On the Association of Warthog and the Nkufo Tick (*Ornithodoros moubata*).—*Ann. Trop. Med. & Parasit.*, 1915. Dec. 30. Vol. 9. No. 4, pp. 559-560.
- (64) MACFIE (J. W. Scott). Observations on the Bionomics of *Stegomyia fasciata*.—*Bull. Entom. Research*, 1915. Dec. Vol. 6. No. 3, pp. 205-229.
- (65) RICARDO (Gertrude). Two new Species of Haematopota from the Federated Malay States.—*Bull. Entom. Research*, 1916. Feb. Vol. 6. No. 4, pp. 403-404.

- (66) RICARDO (Gertrude). Notes on a Collection of Tabanidae from Hong Kong.—*Bull. Entom. Research*, 1916. Feb. Vol. 6. No. 4, pp. 405-407.
- (67) SCHWETZ (J.). Preliminary Note on the General Distribution of *Glossina palpalis*, Rob.-Desv., in the District of Lomami, Belgian Congo.—*Ann. Trop. Med. & Parasit.*, 1915. Dec. 30. Vol. 9. No. 4, pp. 513-526. With 1 map.
- (68) SCHWETZ (J.). Quelques observations préliminaires sur les moeurs de la *Glossina brevipalpis*. [Some Preliminary Observations on the Habits of *Glossina brevipalpis*.]—*Bull. Entom. Research*, 1915. Dec. Vol. 6. No. 3, pp. 289-292. With 1 map.
- (69) SCHWETZ (J.). La limite occidentale de la *Glossina morsitans* dans le Katanga du Nord. [The Western Limit of *Glossina morsitans* in Northern Katanga.]—*Bull. Entom. Research*, 1915. Dec. Vol. 6. No. 3, pp. 283-288. With 1 map.
- (70) STANTON (A. T.). Notes on Sumatran Culicidae.—*Indian Jl. Med. Research*, 1915. Oct. Vol. 3. No. 2, pp. 251-258.
- (71) WATERSTON (J.). Chalcidoidea bred from *Glossina morsitans* in Nyasaland.—*Bull. Entom. Research*, 1916. Feb. Vol. 6. No. 4, pp. 381-393. With 9 text-figs.
- (72) WATERSTON (J.). Notes on African Chalcidoidea—III.—*Bull. Entom. Research*, 1915. Dec. Vol. 6. No. 3, pp. 231-247. With 8 text-figs.
- (73) WATERSTON (J.). Notes on African Chalcidoidea—IV.—*Bull. Entom. Research*, 1916. Feb. Vol. 6. No. 4, pp. 413-423. With 6 text-figs.

Helminths.

- (74) BEAL (W. P. B.). A Common Trematode Worm found in Horses in West Africa (*Gastrodiscus aegyptiacus*, Sonsino).—*Vet. Record*, 1915. Dec. 11. No. 1431, pp. 260-261. With 1 text-fig.
- (75) BEAL (W. P. B.). Two Trematodes: *Dicrocoelium lanceatum* and *Eurytrema pancreaticum*.—*Vet. Record*, 1916. Jan. 29. No. 1438. With 2 text-figs.
- (76) CAWSTON (F. G.). Schistosomiasis in Natal.—*Jl. Trop. Med. & Hyg.*, 1915. Nov. 15. Vol. 18. No. 22, pp. 257-258. With 4 text-figs.
- (77) CORT (W. W.). Egg Variation in a Trematode Species.—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1, pp. 25-26.
- (78) FOSTER (W. D.). Two New Cases of Polyradiate Cestodes, with a Summary of the Cases already known.—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1, pp. 7-19. With 4 text-figs.
- (79) KRECKER (F. H.). *Filaria cingula* Parasitic in the Skin of *Cryptobranchus allegheniensis*.—*Jl. of Parasitol.*, 1915. Dec. Vol. 2. No. 2, pp. 74-79. With 5 text-figs.
- (80) LECOMTE (A.). Les kystes à Filaires (*Onchocerca volvulus*) au Soudan Français. [Filarial Cysts in the French Soudan].—*Bull. Soc. Path. Exot.*, 1915. Nov. Vol. 8. No. 9, pp. 655-656.
- (81) NAKAGAWA (K.). The Mode of Infection in Pulmonary Distomiasis. Certain Fresh-water Crabs as Intermediate Hosts of *Paragonimus Westermanii*.—*Jl. Infect. Dis.*, 1916. Feb. Vol. 18. No. 2, pp. 131-142. With 2 maps & 4 plates comprising 12 figs.
- (82) STUNKARD (H. W.). Notes on the Trematode Genus *Telorchis* with Descriptions of New Species.—*Jl. of Parasitol.*, 1915. Dec. Vol. 2. No. 2, pp. 57-66. With 1 plate comprising 8 figs & 2 text-figs.

- (83) WEIDMAN (F. D.). Report of an Enzootic of Parasitic Proventricular Worms (*Spiroptera incerta* Smith) of Parrots, with Control of Same.—*Jl. Comp. Path. & Therap.*, 1915. Dec. Vol. 28. No. 4, pp. 313-320. With 4 text-figs.

Protozoa.

- (84) FANTHAM (H. B.). Herpetomonads and Vertebrates: A Correction of a Recent Contribution on "Leishmania Problems."—*Jl. Trop. Med. & Hyg.*, 1915. Dec. 15. Vol. 18. No. 24, pp. 277-281.
- (85) MAVOR (J. W.). On the Occurrence of a Trypanoplasm, probably *Trypanoplasma borrelii* Laveran et Mesnil, in the Blood of the Common Sucker, *Catostomus commersonii*.—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1, pp. 1-6. With 1 plate comprising 6 figs.
- (86) SMITH (A. J.) & BARRETT (M. T.). Further Note upon Comparison of *Endamoeba gingivalis* (Gros) and *Endamoeba histolytica* Schaudinn.—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 2, pp. 54-56.
- (87) WATSON (Minnie E.). Some New Gregarine Parasites from Arthropoda.—*Jl. of Parasitol.* 1915. Sept. Vol. 2. No. 1, pp. 27-36. With 2 plates comprising 20 figs.

Miscellaneous.

- (88) BEGUET (M.), MUSSO (L.), & SERGENT (Et.). Troisième campagne contre les Acridiens (*Schistocerca peregrina* Ol.) en Algérie au Moyen du *Coccobacillus acridiorum* d'Hérelle. Note Préliminaire. [Third Campaign against *Schistocerca peregrina* Ol. in Algeria with the *Coccobacillus acridiorum* of d'Hérelle.]—*Bull. Soc. Path. Exot.*, 1915. Nov. Vol. 8. No. 9, pp. 634-637.
- (89) CASTELLANI (A.) & JACKSON (T. W.). Notes on Certain Insecticides.—*Jl. Trop. Med. & Hyg.*, 1915. Nov. 15. Vol. 18. No. 22, pp. 253-255.
- (90) CHALMERS (A. J.) & HADDAD (G.). *Streptococcus equinus* Septicaemia in the Anglo-Egyptian Sudan.—*Jl. Trop. Med. & Hyg.*, 1915. Dec. 1. Vol. 18. No. 23, pp. 265-269.
- (91) FOX (H.). Pancreatitis in Wild Animals.—*Jl. Comp. Path. & Therap.*, 1915. Dec. Vol. 28. No. 4, pp. 298-312.
- (92) GUPTA (M. C.). Anthrax in Elephants.—*Vet. Jl.*, 1915. Nov. Vol. 71. No. 485, pp. 522-530. With 2 text-figs.
- (93) HALL (I. C.) & STONE (R. V.). The Diphtheroid Bacillus of Preisz-Nocard from Equine, Bovine, and Ovine Abscesses, Ulcerative Lymphangitis and Caseous Lymphadenitis.—*Jl. Infect. Dis.*, 1916. Feb. Vol. 18. No. 2, pp. 195-208.
- (94) d'HÉRELLE (F.). La campagne contre les sauterelles en Tunisie en 1915. [The Campaign against Locusts in Tunis during 1915.]—*Bull. Soc. Path. Exot.*, 1915. Nov. Vol. 8. No. 9, pp. 629-633.
- (95) VELU (H.) & BOUIN (A.). Essais de destruction de *Schistocerca peregrina*, Olivier, au Maroc, par l'emploi des cultures microbiennes (*Coccobacillus acridiorum* d'Hérelle.) [Attempts to destroy *Schistocerca peregrina* Olivier with Cultures of the *Coccobacillus acridiorum* of d'Hérelle.]—*Bull. Soc. Path. Exot.*, 1915. Nov. Vol. 8. No. 9, pp. 638-641.

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[No. 2.

THEILERIASIS.

- (96) STRICKLAND (C.). Observations on the Blood in East Coast Fever of Cattle.—*Parasitology*. 1916. Jan. Vol. 8. No. 3. pp. 244–248.

In this paper are recorded a few observations made by the author in 1911.

A small series of blood counts made with the blood of cows prior to infection with East Coast fever and within a day of death showed that, as is generally recognised, there is only a very small amount of blood destruction in this disease. On the other hand the number of corpuscles present in the blood of a dog infected with *Piroplasma canis* was found to diminish by about half a million per day.

Haemoglobin estimations were made by BARCROFT's method, which essentially consists in measuring the pressure of oxygen given off when a given volume of fully oxidised blood is reduced by potassium ferrocyanide, the pressure in the case of a known weight of haemoglobin being known. This method is very delicate but too complex for ordinary purposes.

The results indicated that the amount of haemoglobin present in the blood does not undergo any sensible alteration.

In estimating the specific gravity of the blood the drops of blood were placed in jars containing mixtures of alcohol and xylol of different specific gravities. It was found that there was a slight decrease of specific gravity in each case.

Estimation of the white corpuscles present in the blood showed that there was a very marked leucopenia. In a dog infected with *Piroplasma canis* there was distinct leucocytosis.

Differential counts were made on three occasions with the blood of one cow. About a week after the appearance of the parasites in the blood the eosinophiles numbered 13·6 per cent. Subsequently this figure fell to 2. The leucopenia was found to be due to a relative decrease in the number of cells other than the polymorphonuclears.

- (97) YAKIMOFF (W. L.). A propos de la note de M. Rodhain sur *Theileria ovis*. [A propos of Rodhain's Note on *Theileria ovis*.]—*Bull. Soc. Path. Exot.* 1916. Apr. Vol. 9. No. 4. p. 201.

In connection with the paper recently published by RODHAIN regarding the occurrence of *Theileria ovis* [see this *Bulletin*, Vol. 4, No. 1, pp. 12–14], the author draws attention to the fact that at the Third Russian Veterinary Congress at Kharkow in 1913 he announced his discovery of a parasite of the *Theileria* type in sheep in Turkestan.

TRYPANOSOMIASIS.

- (98) WOELFEL (K.) Beitrag zur Kenntnis der Tsetse (*Glossina morsitans*) und der Trypanosomiasis. [Tsetse Flies (*Glossina morsitans*) and Trypanosomiasis]—Zeitschr. f. Infektionskrankh. parasit. Krankh. u. Hyg. d. Haust. 1915. Aug. Vol. 17. No. 1-2. pp. 19-36. With 1 map.

This paper is a revised summary of two papers published in 1911. Tsetse flies are widely distributed through German East Africa, the largest infested area being Tabora, occupying the greater part of the western half of the Protectorate. According to the natives there are certain areas which have been invaded by the flies comparatively recently, and there is other evidence in support of this statement.

The first record of their occurrence in the district north of Tabora town is that of LICHTENFELD in 1907. Since that date they have steadily increased in numbers.

The flies are found not only along the course of the rivers and streams, but in the wooded country everywhere. As a general rule the flies are more numerous where game abounds. Contradictory views have been expressed by different observers regarding the seasonal distribution of the flies. The author's observations indicate that they generally increase during the rains and reach their maximum just at the beginning of the dry season.

No rule can be laid down with regard to their activity during the day, but it is exceptional to find them active before 7 a.m. Between noon and 3 p.m. they do not appear to be so voracious, but from that time to sunset they are extremely active. There are, however, many exceptions to these indications.

The nature of the weather does not appear to exercise any marked influence upon their activity.

The flies cannot exist in bare country, and it was found by experiment that in wooded country the clearing of a space three hundred metres wide on either side of a road was not sufficient to keep it clear of flies during the dry weather. The flies are unable to live at altitudes greater than 1,300 to 1,400 metres.

Man, mammals, birds, and reptiles are all preyed upon by tsetse flies. In the case of man they generally settle upon the back or the neck, but in animals they more usually select the under side of the body where there is shadow.

Examination of 642 flies showed that 3 per cent. contained trypanosomes. In different districts the number ranged from 1·5 to 10 per cent., the latter number being registered in an area where very few flies were examined.

The blood of sixty-one animals was examined in smears and thick films, and trypanosomes were found in four. In ten cases dogs were inoculated without success, and in six instances attempts were made to cultivate trypanosomes, but no positive results were obtained.

Nagana is very common among the domesticated animals. Native donkeys and cattle appear to recover spontaneously. Attempts to treat infected animals with atoxyl and arsenic yielded very uncertain results. In two cases animals treated with the former drug developed amaurosis, but this was not certainly due to the drug. Salvarsan and trypasafrol also failed to effect cures.

- (99) FIORI (C.) & DELANOË (Mme. P.). Au sujet du dimorphisme du Trypanosome de Mazagan. Deuxième Note. [The Dimorphism of the Mazagan Trypanosome.] *Bull. Soc. Path. Exot.* 1916. Mar. Vol. 9. No. 3. pp. 130-133. With 1 plate, comprising 19 figs.

The authors in a previous communication have shown that the polymorphic trypanosome which they found in a naturally infected horse, when passed into white rats tended to become monomorphic, the parasites without a free flagellum becoming more scanty.

The strain after passage through two dogs was inoculated into a rabbit, and in this animal the dimorphism of the parasite was well maintained. Sixty-one parasites were drawn and measured, and the results showed that apart from the slightly shorter length of the flagellum of the trypanosome in the rabbit, there were no material differences from the parasite as it occurred in the naturally infected horse.

- (100) YAKIMOFF (W. L.) & WASSILEWSKY (W. J.). Le traitement de la trypanosomiase des chameaux du Turkestan russe. [The Treatment of Camel Trypanosomiasis in Russian Turkestan.]—*Bull. Soc. Path. Exot.* 1916. Apr. Vol. 9. No. 4. p. 230.

In this preliminary note the authors summarise the results that they have obtained in the treatment of mice infected with the camel trypanosome by means of various drugs.

With atoxyl administered in full subtoxic doses relapses always occur, and arsinosolvine yields similar but slightly inferior results.

Salvarsan is the best drug for the treatment of the infection.

Emetic acts successfully only when doses that are almost toxic are given.

Trixidin is a good remedy; the minimum dose to effect a cure is 0·001 g. per kilo.

Trypanblue fails even when toxic doses are given, and dianilblue gives slightly better results.

Repeated injections of either atoxyl or emetic fail to effect permanent cures. Similarly, atoxyl or emetic in combination with trypanblue or dianilblue have not yielded any positive results.

- (101) YAKIMOFF (W. L.) & SCHOKHOR (N. J.). A propos du *Trypanosoma theileri* au Turkestan russe. [*Trypanosoma theileri* in Russian Turkestan.]—*Bull. Soc. Path. Exot.* 1916. Apr. Vol. 9. No. 4. p. 229.

In 1913 the authors announced the discovery of *T. theileri* or a related type in the blood of cattle at Taschkent by cultivation in ordinary broth. Examination of blood from 1,000 animals by the microscope failed to reveal a single trypanosome.

They now state that they have found a trypanosome of this type in the course of the examination of 193 liver smears.

- (102) RODHAIN (J.) & Van den BRANDEN (F.). Sur la réceptivité de la roussette, *Cynonycteris straminea*, aux différents virus de trypanosomes africains. [The Susceptibility of the Flying-Fox to Different Strains of African Trypanosomes.]—*Bull. Soc. Path. Exot.* 1916. Apr. Vol. 9. No. 4. pp. 234-236.

The authors have failed to infect flying-foxes with *T. lewisi*, *T. cazalboui* (*vivax-angolense*) and *T. congolense*.

They have fatally infected two with *T. gambiense*. Death occurred in 52 and 68 days respectively.

Observations indicated that *T. gambiense* does not undergo any development in *Cyclopodia greffi*, which swarmed on the animals.

- (103) BOUET (G.). Existence d'un petit foyer de trypanosomiase humaine à la Basse Côte d'Ivoire. [The Existence of a Small Centre of Human Trypanosomiasis in the Coastal Area of the Ivory Coast.]—*Bull. Soc. Path. Exot.* 1916. March. Vol. 9. No. 3. pp. 168-186.

Up to 1913 the coastal region of the Ivory Coast appeared to be free from human trypanosomiasis, although the disease was endemic and had been so for many years in the upper parts of the colony. In 1913 a case was detected in a native child which had never been outside the area, and investigation revealed a second case in a child in Bingerville, the capital. Events made it impossible to complete the investigation.

In seeking the reservoir of the virus an examination of the domesticated animals was undertaken, but with entirely negative results, no trypanosome resembling *T. gambiense* being found.

The investigations have however enabled the author to confirm his previous work regarding the endemicity of *T. dimorphon* in the Ivory Coast. This was in fact the only trypanosome discovered in animals that had lived for a long time in the capital (in the government herd).

Among the animals brought down for slaughter or conveyed from the north by rail *T. cazalboui* was found, this also confirming previous investigations.

The dwarf cattle of the forest and coast regions have acquired a high degree of resistance to infection with *T. dimorphon*, but imported Soudanese cattle are rapidly killed by the infection. The native cattle in the northern area, where *T. cazalboui* is common, have in the course of time acquired a high degree of resistance to *T. cazalboui*.

Examination of flies showed that not one out of 450 capable of carrying the human trypanosome was infected. On the other hand 3·7 per cent. of the flies were found to be infected with *T. dimorphon*. A single fly out of 450 was found to be infected with *T. cazalboui*, but this infection was probably derived from one of the northern animals brought down for slaughter.

(104) STUEHMER (A.). Ueber lokale ("primäre") Krankheitserscheinungen an der Stelle der Infektion bei der Nagana-Erkrankung des Kaninchens ("Trypanosomenschanker"). Ihre Bedeutung für die Beurteilung des Verlaufes der Kaninchentrypanosomiasis. Uebergang des "primären" in das "sekundäre" Krankheitsstadium (Rezidivstammbildung). [The Local or Primary Symptoms at the Seat of Inoculation of Rabbits inoculated with Nagana. The Transition from the Primary to the Secondary Stage.]—*Zeitschr. f. Immunitätsforsch.* I. Teil. Orig. Mar. 1914. Vol. 24. No. 4. pp. 315-335.

The author points out that investigations connected with the treatment of syphilis are hindered by the difficulty of producing generalised disease in animals, and he has therefore carried out a series of experiments with rabbits infected with nagana, there being some similarity in the course of the two infections, particularly in the early stages.

STARGARDT, whose publication the author refers to, was able to produce chancre-like lesions in rabbits infected with nagana, and Stühmer has used the Morgenroth strain of trypanosomes from the Ehrlich Institute for a similar series of experiments. He has been able to produce the local lesions in every case.

His procedure was to inoculate the animals into the connective tissue immediately above the limbus corneae with a suspension of trypanosomes obtained from mice inoculated intraperitoneally.

No abnormality was observed at the seat of inoculation until the second or third day when there was swelling and congestion of the cornea. In some cases the swollen tissues became pale red, and in other cases a dark bluish-red. In some instances there was also some slight turbidity of the upper part of the cornea. By the fifth day the inflammatory process had spread to the surrounding tissues and the condition reached its maximum on the following day, after which the symptoms gradually disappeared.

In some instances the author was able to find trypanosomes in large numbers in the liquid obtained by slightly scarifying the swollen membrane, and they were extraordinarily numerous by the third day. They could not be detected in the blood even by inoculation at this stage. Inoculation tests generally revealed the presence of trypanosomes in the blood on the fourth or fifth day.

The author was able to produce a similar local lesion by inoculating into the scrotum.

Microscopic examination of the local lesion of the eye showed that surrounding the inflamed tissues at the seat of inoculation there was produced a cellular infiltration mainly composed of plasma cells and polynuclear leucocytes.

In the scrotal lesion the zone of cells closest to the seat of inoculation was composed almost exclusively of polynuclears, the plasma cells being present in large numbers in the oedematous area external to this. Around the vessels there was a marked small-celled infiltration.

Trypanosomes could be detected at the seat of inoculation, but they were scanty or absent in the oedematous tissues surrounding it. It was only in the immediate neighbourhood of the vessels that they could be discovered.

These lesions are called the primary lesions of trypanosomiasis and they are compared by the author to the primary lesions of syphilis.

The author shows that in inoculated rabbits there is a development of antibodies which leads to the disappearance of parasites from the blood after they have first made their appearance there, and that the trypanosomes which reappear in the blood differ biologically from those which first appear in the blood in that they are resistant to antibodies.

By inoculating a rabbit at short intervals he shows that the capacity of the parasites for producing the local lesions gradually becomes less as the antibodies produced by the first inoculation increase.

The so-called antibody-resistant strain of trypanosomes which occurs in the blood after the first disappearance of parasites is responsible for secondary lesions involving the genitals, lips, ears, etc.

- (105) RODHAIN (J.) & Van den BRANDEN (F.). Action comparative des matières colorantes : tryparosan et trypanbleu et des arsenicaux : salvarsan cuprique, sur les trypanosomes animaux africains des groupes *congolense* et *angolense* (*cazalboui-vivax*). [The Comparative Effects of Colouring Materials : Tryparosan and Trypanblue and Arsenical Compounds : Copper Salvarsan on African Animal Trypanosomes belonging to the *Congolense* and *Angolense* Groups (*cazalboui-vivax*).]—*Bull. Soc. Path. Exot.* 1916. Apr. Vol. 9. No. 4. pp. 236-241.

A sheep, a ram, a goat, a native pig, and two guinea-pigs infected with *T. congolense* were treated with tryparosan administered by the mouth, in a dose of 0·5 g. per kilo. In every case trypanosomes disappeared from the circulation and did not reappear during the periods for which the blood of the various animals was subsequently examined. These periods were in most cases about a month, but in one instance extended to eight months.

Trypanblue administered either by the mouth or by intravenous injection failed to disperse the trypanosomes and failed to alter the course of the disease.

Copper-salvarsan injected intravenously into two sheep infected with *T. congolense* in a dose of 0·008 g. per kilo. failed to cause the disappearance of the parasites.

In a previous publication the authors have shown that *T. cazalboui* (*vivax*) is susceptible to tryparosan, and in this paper two further experiments are quoted in support of this.

In one case a sheep was given 0·6 g. intravenously in error, the intended dose being 0·3 g. Intense dyspnoea resulted and the sheep was in a dangerous condition for a couple of hours, but recovery took place and no relapse was observed.

In the second case the sheep received 0·3 g. intravenously. Trypanosomes disappeared but returned in about three weeks. A further dose of 0·35 g. apparently effected a cure as no trypanosomes were discovered during the next three months.

Trypanblue failed to produce any effect upon *T. cazalboui* (*vivax*), and, similarly, salvarsan copper was practically without effect.

(106) BOUILLIEZ (M.). Contribution à l'étude et à la répartition de quelques affections parasitaires au Moyen Chari (Afrique Centrale). [Certain Diseases occurring in the Middle Shari Area (Central Africa).]—*Bull. Soc. Path. Exot.* 1916. Mar. Vol. 9. No. 3. pp. 143-167. With 6 text-figs. and 1 map.

In this report the author deals with the following conditions:—Human trypanosomiasis, Animal trypanosomiasis, Leishmaniasis, Malaria, Piroplasmosis, Filariasis, and Goitre.

With regard to the first of these the author has investigated the distribution of the disease and the degree of incidence in endemic areas. For the identification of the trypanosome a certain number of animal inoculations have been carried out. The resulting infections have resembled those caused by *T. gambiense*, but have always been rather less virulent. In stained preparations the parasite appeared to be identical with *T. gambiense*, and no posterior-nuclear forms were found. The author therefore thinks that the parasite is not *T. rhodesiense*, but that if its feeble pathogenicity is a sufficient character for the creation of a species it is possibly *T. nigeriense*.

No specimens of *G. palpalis* have been found, and the author thinks that *G. morsitans* and *G. tachinoides* must be excluded as transmitters of the disease as they are both common all along the banks of the rivers while sleeping sickness has a very localised distribution.

Among the large domesticated animals pathogenic trypanosomes have been found in horses, asses, cattle, and kids. The parasite most frequently found, and possibly the only autochthonous one, is *T. pecaudi*.

Other species have been detected, but only in animals passing through the district or brought into it from elsewhere.

T. pecaudi is a very frequent cause of death among horses and it has been discovered on many occasions in asses, but it is only rarely present in the blood of the other species mentioned.

Two opportunities presented themselves of treating horses affected with baleri. Atoxyl and orpiment were used, but without success in both cases.

T. cazialboui and *T. dimorphon* have also been found, the latter in a donkey from the Egyptian Soudan. Details are given of a number of experimental inoculations carried out with the latter trypanosome.

Another trypanosome found in a horse, which in all probability came from Léré, presented morphological characters which recalled *T. congoense*, *T. nanum*, and *T. pecorum*. But the second of these appeared to be excluded as the parasite was pathogenic for the dog. *T. pecorum* and *T. congoense* also appeared to be excluded as the parasite was found to be not pathogenic for the monkey, cat and rat.

Two cases of leishmaniasis were encountered, and *L. tropica* was found in preparations made from the boils. The author is inclined to think that the disease is more common than would appear from the fact that he found only two cases in two years, as there are many cases of chronic ulcers in which the parasite cannot be found, but which he thinks are due to Leishmania.

In two cases of splenomegaly spleen puncture was practised, but with negative results as regards the presence of Leishmania. No cases have been found in dogs.

About 80 per cent. of the blood smears examined contained malarial parasites, and in about 90 per cent. of cases the parasite was *Pl. praecox*.

Plasmodium kochi was found in one monkey out of about 30 kept under constant observation. Gametes were present in the blood of this animal daily for about three weeks prior to its death. For a period of five days terminating four days before death schizonts were also present.

Four other monkeys inoculated from it either before or at the time of death all failed to become infected.

A small outbreak of piroplasmosis occurred in a recently purchased herd of cattle, but it did not appear to spread to other animals mixed with them. At the time of death parasites were present in the blood in large numbers, but not more than two were found in a single corpuscle. The majority were elongated, with a speck of chromatin at one end.

Various forms of filariasis are encountered in the area.

Goiitre is extremely common. In some of the villages near Goundi nearly 80 per cent. of the people are affected. Men, women and children are all affected, and even dogs, kids, and horses. The disease occurs at all seasons. The author has not been able to find any cause for its development. There is no evidence that it is hereditary.

LEISHMANIASIS.

- (107) LAVERAN (A.). Leishmaniose cutanée expérimentale chez les macaques et chez le chien. Conditions de l'immunité. [Cutaneous Leishmaniasis in Monkeys and Dogs. The Production of Immunity.]—*Bull. Soc. Path. Exot.* 1916. Apr. Vol. 9. No. 4. pp. 265-275. With 1 plate.

The author has been able to infect monkeys with *L. tropica* with certainty by the following procedure. The skin on the outer side of the thigh is shaved and washed with hydrogen peroxide, and punctures are made obliquely through it with a vaccinostyle at a distance of at least one centimetre from each other. When bleeding has stopped a fragment of tissue taken from a mouse infected with the parasite is inserted into each of the punctures. When this plan is adopted the period of incubation is very short.

It has been found that recovery from infection produced in this way is sometimes followed by immunity. In dogs reinoculation after recovery from a primary infection is generally followed by a relapse, but the lesions produced are as a rule smaller and persist for a shorter length of time than those resulting from the primary inoculation.

Inoculations after recovery from a second infection are generally abortive, but it sometimes happens that positive results can be obtained when several months have elapsed since recovery from the second inoculation.

- (108) LAVERAN (A.). Infections expérimentales de la souris par la *Leishmania tropica*; un cas d'infection par la voie digestive. [Experimental Infection of Mice with *Leishmania tropica*; a Case of Infection by the Digestive Tract.]—*C. R. Acad. Sci.* 1916. Jan. Vol. 162. pp. 187-190.

On six occasions during May and June 1915 the author introduced into the mouth of a white mouse four or five drops of culture of *L. tropica* obtained on simplified Novy medium. The material was introduced into the mouth by means of a glass pipette which was not allowed to come into contact with the mucous membrane.

Towards the end of January 1916 it was observed that the left tarso-metatarsal articulation was markedly swollen. The swelling was congested and painful, and caused lameness. A drop of serous liquid obtained from the joint with a pipette was found to contain enormous numbers of parasites, both free and included within cells.

The mouse was in a cage by itself and had no fleas on it.

At the time of writing no other lesions had made their appearance, but the author thinks it probable that the lesion will extend, that areas of gangrene of the skin will appear, and that, finally, the condition will become septicaemic as in the experimentally inoculated mice.

- (109) LIGNOS (A.). La Leishmaniose canine à Hydra. [Canine Leishmaniasis in Hydra.]—*Bull. Soc. Path. Exot.* 1916. May. Vol. 9. No. 5. p. 302.

During the warm season (May to October) 1912 the author examined 48 dogs and found 16·6 per cent. infected.

During the cold season October 1914-April 1915, 78 dogs were examined and 8·9 per cent. of infected animals were found.

- (110) NICOLLE (C.). Chronique du Kala-azar en Tunisie. [Kala-azar in Tunis.]—*Bull. Soc. Path. Exot.* 1916. Mar. Vol. 9. No. 3. pp. 126-129. With 1 text-fig.

Since the last statistics were published in June 1914 the number of cases of the disease occurring among children has risen from 38 to 45. The seven children range from eight months to seven years old, and in six of the cases the parents are Italian.

It is observed that the majority of cases occur in children about three years old, that boys are more frequently affected than girls, and that more cases occur among the Italians than other races.

The author has four strains of *Leishmania donovani* in culture, all of which have passed through a hundred or more generations. Two are of human origin and were derived from children, and the other two are from naturally infected dogs. The author refers to these strains as varieties of *L. donovani*.

A strain of *L. tropica* became contaminated at the 135th generation, and was allowed to die out, but it was recovered from a man inoculated with it, and has since passed through 31 generations on NNN medium.

Attention is drawn to the occurrence of an anaemia associated with enlargement of the spleen which does not appear to be due to kala azar. Eight cases have been observed in Tunis during 1914 and 1915. All were in boys under six years of age.

Contrary to what appears to be the case with kala azar, the majority of cases of this disease were seen in children of races other than Italian.

The prognosis is more favourable than in kala azar, and the majority of cases recover.

SPIROCHAETOSIS.

- (111) YAKIMOFF (W. L.), SCHOKHOR (N. J.) & KOSELKINE (P. M.).
Spirochétose des poules au Turkestan russe. [Avian Spirochaetosis in Russian Turkestan.]—*Bull. Soc. Path. Exot.* 1916. Apr. Vol. 9. No. 4. pp. 227-228.

The authors briefly record the occurrence of spirochaetosis in fowls and state that they were able to transmit the infection by means of *Argas persicus*.

Intramuscular injections of atoxyl in doses ranging from 0·03 to 0·1 gramme according to the weight of the birds effected cures.

UNDULANT FEVER.

- (112) LABONNOTTE (X.) & DELANOË (M. et Mme. P.). *Au sujet de la Fièvre ondulante à Mazagan.* [Undulant Fever at Mazagan.]—*Bull. Soc. Path. Exot.* 1916. Apr. Vol. 9. No. 4. pp. 207-211.

The authors record the occurrence of the first two cases of undulant fever at Mazagan, and draw attention to the fact that the goats which supply the town with milk come from Malaga (Spain), where the disease is endemic.

- (113) NICOLLE (C.) & GOBERT (E.). *Nouvelle enquête sur les chèvres laitières de Tunis. Troisième Mémoire.* [Further Inquiry into the Milch Goats of Tunis. Third Memoir.]—*Arch. Inst. Pasteur Tunis.* 1916. Apr. Vol. 9. No. 3. pp. 157-175. With 1 map.

This paper has appeared in a somewhat shortened form in the *Bull. Soc. Path. Exot.*, 1916 Feb. Vol. 9, No. 2, of which an abstract is given on page 17 of Volume 4 of this *Bulletin*.

The present paper includes all that previously published, but in addition the texts of the regulations drawn up and the detailed distribution of the infected animals are given.

RINDERPEST.

- (114) PIOT-BEY. *Immunisation du bétail égyptien contre la peste bovine par la méthode simultanée du sérum et du sang virulent. Durée de l'immunité.* [The Immunisation of Egyptian Cattle against Rinderpest by the Simultaneous Method with Serum and Virulent Blood. The Duration of the Immunity.—*Ann. Inst. Pasteur.* 1916. Apr. Vol. 30. No. 4. pp. 187-194.]

The first attempt at carrying out active immunisation on a large scale was made at the commencement of the outbreak in 1903, which

carried off in less than a year more than a third of the cattle population of Egypt. This disastrous result was probably due to the inferior quality of the various sera used. Up to 1912 the serum alone method was exclusively employed. It was found however that the method was a failure, and on the State Domains considerable success was obtained in the control of the disease by the enforcement of isolation. While this was possible in the controlled areas, it was quite out of the question in other parts of the country, and there was every chance of the disease persisting indefinitely unless other measures could be resorted to.

The results obtained by GORDON at the Serum Institute proved that a valuable serum could be prepared, and it was tested on a herd of 52 animals in 1912. Each animal received 100 cc. of serum and 2 cc. of virulent blood. Twenty-eight of these animals gave marked reactions, and three of them showed, in addition, symptoms of piroplasmosis. One of the latter died.

A fortnight after the immunisation 30 animals taken indiscriminately from the whole herd were subjected to a test inoculation with 10 cc. of virulent blood. Not one reacted, thus proving that the vaccination had been effective, and that the animals which did not react to the vaccination already possessed an immunity to the disease.

In consequence of this good result the operation was undertaken on a large scale, and during the period June 1912 to February 1913, 1,958 animals were inoculated.

A practical test of the value of the immunity conferred by the method is that although the disease has made its appearance in the neighbourhood of State Farms on a number of occasions, not a single case has arisen among the vaccinated animals for more than three years. Further, when a severe outbreak occurred causing hundreds of deaths among outside animals, the vaccinated animals were lent to the farmers to enable them to work their cotton crops, and thus worked side by side with unprotected animals in heavily infected areas for more than a month, and not a single case of the disease occurred.

The immunity conferred by the vaccination was tested by inoculations with doses up to 10 cc. of virulent blood at intervals ranging up to three years after vaccination, and no reaction was produced in any. The number of animals tested in this way was 681.

Of 2,010 animals inoculated, two only have shown lesions suggestive of rinderpest, and in both cases their blood was proved to be inactive. Sixteen animals died of piroplasmosis, either of Texas fever, or of the Egyptian form of the disease. Three died of tuberculosis during the month following the inoculation. Four animals showed general paralysis or paraplegia, and one of these recovered. It is therefore seen that the losses following the vaccination, including all accidental losses, amounted only to about 1 per cent., and that piroplasmosis is the most serious of the complications.

At the suggestion of GAUTIER hypothermic (hypodermic ?) injections of arrhenal have been used for the treatment of cases of piroplasmosis, and it has been found possible to cure every case, provided intervention is possible on the first day of the disease, and that it is not complicated with any other disease.

On the results obtained with the domains cattle a systematic vaccination of the cattle in the different districts, beginning with the cotton areas, was authorised by the Government.

LITTLEWOOD's report shows that the mortality among 290,726 animals vaccinated amounted to 1·45 per cent.

FOOT AND MOUTH DISEASE.

- (115) Cosco (G.) & AGUZZI (A.). *La virulenza del sangue degli animali malati di afta epizootica.* [The Virulence of the Blood of Animals infected with Foot and Mouth Disease.]—*Clinica Vet.* 1916. Apr. 15. Vol. 39. No. 7. pp. 193-195.

In this short paper the authors publish the conclusions drawn from a number of observations regarding the virulence of the blood of animals infected with foot and mouth disease. A full publication is promised at a later date.

The conclusions may be summarised as follows:—

The blood is virulent during the whole of the febrile period, and its virulence is greater than that of the liquid obtained from the lesions. Both serum and corpuscles inoculated separately are capable of producing the disease, and they appear to be of equal virulence. Defibrinated blood kept in an ice chest retains its virulence for a month or more. Under these conditions the corpuscles retain their virulence longer than serum.

One cubic centimetre of corpuscles that have been repeatedly washed with sterile physiological salt solution is capable of producing the disease by subcutaneous inoculation. A similar dose of serum is also capable of setting up infection.

The inoculation of bovines in series does not exalt the virulence of the virus.

Washed corpuscles administered by the mouth apparently fail to produce infection.

RABIES.

- (116) KONRADI (D.). *Hérédité de la Rage. (Deuxième Note.)* [Transmission of Rabies by Heredity. (Second Note.)]—*Ann. Inst. Pasteur.* 1916. Jan. Vol. 30. No. 1. pp. 33-48.

The previous communications in connection with this subject were published by the author in 1904 and 1908. The present paper is published because since the latter date a number of authors have expressed views contrary to those held by Konradi, who brings forward further observations in support of his views.

In May 1909 a child which had been bitten died after having shown symptoms of rabies in the Pasteur Institute at Budapest. The author received some "virus" from this case in carbolised glycerin. The sterility of the virus was tested by sowing it on agar, and it was then used for the subdural inoculation of a rabbit. Two guinea-pigs were

also inoculated deeply beside the dorsal spine. The guinea-pigs died of rabies in 23 and 26 days. On the 12th and 13th days the rabbit showed an elevation of temperature, and after an interval of 20 days its temperature rose again. On the following day it gave birth to three young ones which died on the fourth day. The rabbit died of rabies thirteen months later. Negri bodies were not discoverable in the brains of the young rabbits, but all three were used for the subdural inoculation of rabbits and guinea-pigs.

One of the guinea-pigs died of rabies on the 23rd day. The rabbit inoculated from the same brain survived for fourteen months without showing symptoms and was then used for another experiment.

Similar results were obtained with the animals inoculated from the brain of the second young rabbit, the guinea-pig dying from rabies and the rabbit surviving for six months and then dying of another disease.

The guinea-pig inoculated from the third rabbit died on the 26th day of rabies, and the rabbit died on the 725th day. Numerous Negri bodies were found in its brain.

The brain of the guinea-pig inoculated from the second young rabbit was used for the further inoculation of a guinea-pig and a rabbit. The guinea-pig died on the 28th day, and it was noted that symptoms appeared only on the day before death. The guinea-pig from which it was inoculated showed symptoms for five days. The rabbit died on the 529th day.

The author publishes a number of observations on similar lines.

Special interest attaches to a case related by the author in which a dog in apparent good health bit a child. Eleven days later it bit another dog while it was under the author's observation. The following day it showed furious symptoms and died. It was subsequently learned that it had bitten another dog fourteen days before its death. This dog died while under the author's observation on the 39th day with all the characteristic symptoms of rabies.

Upon this evidence the author points out that it is an error to suppose that if a dog lives for ten days after biting some one there is no risk of rabies developing.

The author's conclusions may be summarised as follows :—

The virus of rabies is transmitted from mother to foetus, but if this occurs in series the virulence gradually diminishes. This appears to hold good for many species of animals :—dogs, rabbits, guinea-pigs, and probably other animals.

Guinea-pigs are preferable to rabbits for experiments of this kind, as they are more susceptible to rabies, and more rapid and certain results are thereby obtained. The late development of the disease in the rabbit probably explains the negative results obtained by other authors.

In any case the animals must be kept under observation for long periods.

The virus is present in the blood when the temperature rises. This is the first symptom in experimental rabies. The bites of dogs may be dangerous fourteen days before the appearance of clinical symptoms.

- (117) ARCHIVES DE L'INSTITUT PASTEUR DE TUNIS. 1916. Apr. Vol. 9. No. 3. pp. 201-204.—Fonctionnement des Services de l'Institut Pasteur pendant l'année 1915 (Tunis). Service Antirabique. [Anti-Rabic Treatment during 1915 in Tunis.]

The number of persons presenting themselves for treatment during the past year was 443 as compared with 403 during 1914.

In fifteen cases the treatment was not completed owing to discovery that the dog responsible for the bite was not affected with rabies, and in eight further instances the patients, for no apparent reason, did not have the complete course.

In five cases death occurred before the final inoculation was given. The people were either severely bitten or failed to come for treatment early enough. No deaths occurred among the remaining 415.

Since the establishment of the Institute 5,711 persons have been treated, and the mortality is 0·315 per cent.

Of the animals responsible for the bites 399 were dogs, 16 cats, three donkeys, one horse and one ox. In 199 cases the animals were domesticated and in 194 stray. But for the established fact that the disease is mainly kept alive among domesticated dogs it would be difficult to explain the higher figure among the domesticated animals.

In 102 cases experimental inoculation was resorted to for the establishment of a diagnosis, with positive results in 40 of these. In the remaining cases the animals were only suspect.

PROTOZOA.

- (118) PORTER (Annie). The Occurrence of *Pneumocystis carinii* in Mice in England.—*Parasitology*. 1916. Jan. Vol. 8. No. 3. pp. 255-259. With 8 text-figs.

After briefly summarising the observations that have been made in connection with the occurrence of protozoal cysts in the lungs of various animals and the errors that have been made in regarding these as stages in the development of trypanosomes, the author passes to a description of the parasite found in the lungs of a wild mouse killed at Cambridge.

The parasites were not found elsewhere than in the lungs. They were examined fresh and after intra-vitam staining with methylene blue.

The youngest phases were rounded bodies measuring about 5 microns with finely granular protoplasm and a single nucleus. They were either free or enclosed in endothelial cells. The cyst wall varied in thickness in different individuals. The older cysts showed phases of development into two, four and eight nuclei. By separation of the cytoplasm off around each of the nuclear fragments eight merozoites were formed. The mature cysts measured about 6·5 microns.

The vermicular merozoites measured from 1·5 to 2·5 microns in length by 0·5 in width. The free merozoites moved slowly, and rapidly became rounded.

The author thinks that the encysted parasites leave the host by way of the mucus in the oral or nasal secretions, and that the passage from host to host is probably by the contaminative or casual method.

The zoological position of the parasite is not yet established and no sexual forms have been discovered.

(119) PEARCE (Louise). *Klossiella Infection of the Guinea-pig.—Jl. Experim. Med.* 1916. Apr. Vol. 23. No. 4. pp. 431-442.
With 8 plates comprising 21 figs.

The author encountered this parasite while carrying out investigations regarding the effects produced by arsenical compounds on the kidneys. Examination of sixty animals obtained from Philadelphia and New Brunswick showed that 20 per cent. were infected.

The form of parasite most frequently encountered was a small round or ovoid body measuring about 7 microns in diameter and containing a number of pieces of chromatin scattered through its substance. These fragments are either large and irregular or mere specks. The parasites generally occur free in the lumen of the straight tubes in the inner part of the cortex, or less frequently in the convoluted tubes and Bowman's capsule. That the parasites were originally enclosed in epithelial cells is shown by the fact that in many cases a thin limiting membrane composed of the remnants of the cell can be made out.

Each of these parasites divides into eight or twelve bodies which are falciform and surrounded by a distinct membrane. Each of these contains a single particle of chromatin.

The rounded bodies above referred to appear to be derived by a process of division from rounded structures of much larger size.

In another stage parasites measuring 18 to 20 microns in diameter are found enclosed in epithelial cells. These parasites are divided up into a number of segments which in sections appear to be arranged in a ring. Each segment contains one or two chromatin dots.

The individual segments of the ring forms appear to be ovoid in shape and to measure 5 to 8 microns in length by 3 to 5 in width. At one end there is a large mass of chromatin, and at the other an area that does not take any stain.

From appearances presented by the section it would appear that these bodies enter fresh epithelial cells.

In one kidney large parasites which appeared to be schizonts were found, the merozoites closely resembling the previously described falciform parasites which were considered to be sporozoites.

No gross lesions of invaded kidneys have been found, but the author is inclined to think that collections of fibroblasts found especially around the glomeruli may be due to the presence of the parasites in the organs. There appears, however, to be no reaction in the immediate neighbourhood of the parasite.

The author thinks that while the parasite here described resembles that described by SEIDELIN, in many respects it differs from it markedly, in that only eight to twelve sporozoites have been found whereas SEIDELIN found as many as thirty.

- (120) PETTIT (A.). *Sur un sporozoaire parasite du cobaye, appartenant au genre *Klossiella* Smith and Johnson.* [A Sporozoan of the Guinea-Pig belonging to the Genus *Klossiella* Smith and Johnson.]—*C. R. Soc. Biol.* 1916. Feb. 19. Vol. 79. No. 4. pp. 168–170.

This brief note contains a description of such forms of the parasite as the author was able to discover in the kidney of a single infected guinea-pig.

The parasites were found almost exclusively in the striated epithelial cells. The smallest forms were rounded bodies about 7 microns in diameter with fine basophil granules in their cytoplasm. The nucleus of the host cell shrinks, but the cytoplasm appears to form a kind of envelope for the parasite. Division occurs by a process of karyokinesis, and the daughter parasites arrange themselves at the periphery, leaving a central residual body. At this stage the parasite may measure 30 microns. The bodies produced by division are oval in shape and measure 10 microns.

No further stages of development were seen.

Very slight changes were produced in the invaded tissues apart from the lesions of the cells themselves. There was no production of inflammatory tissue.

The author draws attention to the fact that this parasite was first described by PIANESE in 1901.

- (121) CARINI (A.). *Ueber die Hundekrankheit Nambi-uvu und ihren Parasiten.* [Nambi-uvu, a Disease of Dogs, and its Parasite.]—*Centralbl. f. Bakteriol.* 1 Abt. Orig. 1915. Dec. 29. Vol. 77. No 3. pp. 265–271. With 2 plates comprising 27 figs.

The disease known in Brazil as Nambi-uvu is responsible for considerable mortality among dogs, and especially among hounds. The name signifies bleeding from the ear, which is one of the commonest symptoms of the condition. The disease is also known as yellow fever on account of the frequency with which jaundice is a symptom.

Reference was made to the disease by the author in 1908 when he expressed the suspicion that it might be a piroplasmosis. Two years later the study of the disease was taken up by RANGEL PESTANA who discovered the causal organism and named it *Piroplasma vitalii*.

The disease occurs at all seasons of the year, but especially in the summer, and it mainly attacks dogs about a year old.

Three forms of the disease are recognisable. An acute form which runs a rapid course and is characterised by dullness and loss of appetite, unsteadiness of gait, irregularity of temperature, pronounced jaundice, progressive anaemia, and which terminates fatally in from three to ten days. A subacute form of which the principal symptom is haemorrhage from the skin of the ears, back or other part of the body. The dermatorrhagia is spontaneous and recurs at more or less regular intervals. Internal haemorrhage occurs and there is practically always enlargements of the lymphatic glands.

In the chronic form of the disease the symptoms are not at all characteristic, and clinical diagnosis is practically impossible. Loss of appetite, weakness, anaemia and progressive emaciation are observed. The majority of the chronic cases recover.

The disease is transmissible to dogs by all methods of inoculation, but not by ingestion. Inoculation generally results in the production of the acute form of the disease, the haemorrhagic form being rarely produced in this way, although that is the commonest form of the disease in natural cases.

In young puppies the period of incubation is from three to ten days and death is not long delayed.

When adult dogs are inoculated the result is either the production of the chronic form of the disease or the inoculation fails, probably owing to a previously acquired immunity. In these circumstances the period of incubation may be as long as 25 days. It varies with the virulence of the parasite and the susceptibility of the dog.

The parasites are usually very scantily present in the blood, and in some cases of a clinically identical disease they could not be discovered either in the original dogs or in young dogs inoculated from them. These facts suggest to the author that there may be two distinct diseases having similar clinical pictures but caused by different organisms.

The lesions, apart from those of jaundice, are enlargement and softening of the spleen. The kidneys are enlarged and show petechiae. The cortical portion of the adrenals is enlarged. The bone marrow is diffused and of an intense red colour. The cause of the condition is a protozoal parasite which to some extent resembles *Piroplasma canis*, but differs from that organism in certain important characters.

The organism can be found in the blood in acute cases, particularly in the later stages, but it is exceptional to find it in large numbers. In less severe cases it may be quite impossible to find the parasite in the blood.

The parasites are intracorporeal and range from 2 to 4.5 microns in diameter. In cases where they are numerously present in the blood autoagglutination of invaded cells may be observed. In stained preparations (Romanowsky) the cytoplasm stains blue and has an alveolar structure. The nucleus is compact, excentrically placed, and stains bright red.

The parasites vary somewhat in shape, appearing rounded, oval or pear-shaped. They frequently occur in pairs. Multiplication is by binary division, the nucleus dividing first. Multiple invasion of red corpuscles occurs.

In smear preparations from organs, and better still in sections, parasites undergoing schizogony can be found. These occur in connective tissue corpuscles and in endothelial cells. The multiplication by binary fission and by schizogony resembles that seen in *Toxoplasma*. The author holds that this parasite is distinguished from *Piroplasma* by the fact that in the latter multiplication by schizogony is never known to occur, and suggests that a new genus "Rangelia" should be made for it.

All attempts to cultivate the parasite have failed.

The parasite persists in the body for long periods after recovery has taken place.

As yet no positive results have been obtained in experiments to test the part played by ticks in the transmission of the disease, but the fact that it occurs more frequently in dogs in the country than in towns suggests that it may be tick transmitted.

Trypanblue has been used successfully in the treatment of the disease.

- (122) SMITH (T.). Aberrant Intestinal Protozoan Parasites in the Turkey.—*Jl. Experim. Med.* 1916. Mar. Vol. 23. No. 3. pp. 293-300. With 1 plate, comprising 4 figs.

The bird in which the parasite here described was found was about two months old when it was chloroformed to death on account of symptoms of dullness and loss of appetite. The disease under investigation at the time was the so-called blackhead, and the bird was destroyed with the object of obtaining fresh materials for examination as to the presence of the parasite that is responsible for that condition. No evidence of blackhead was found in it.

The bird had been raised along with several others in an incubator and a brooder on ground where no adult turkeys or poultry had been for several years.

Several coccidia measuring 24 by 17 microns were found in the faeces passed during the chloroforming. Subsequently examination of pieces of the intestine fixed in Zenker showed that peculiar bodies, which were taken to be asexual stages of a coccidium, were present in very large numbers in the subepithelial layer of the mucous membrane, while few were present in the epithelial layer.

The author refers to various publications in which the presence of coccidia in tissues other than epithelium has been described.

The degree of invasion appeared to be about the same in the upper, middle, and lower parts of the small intestine.

The epithelium was still present, but raised from the core of the villi, the intervening space being filled with what is described as "a network of circular lines of a precipitate made up of fine granules."

"The parasites were visible under a low power as vacuoles arranged in an almost continuous band near the margin of the villus core. Occasional bodies were nearer the central axis of the villus. Under high powers these vacuole-like bodies were found to be partially empty. A few were well filled. They consisted of some host cell whose cytoplasm had been moulded into a shell (or ring in section) with the much flattened nucleus against this shell. The contents were a very fine lining membrane within which were roundish bodies of various diameters, 2 microns or more, staining feebly reddish and with or without a mass of chromatin. Frequently a body contained two chromatin masses situated at opposite poles, as if division had taken place. Those bodies which were full of the small spheres, contained about 16 or more of more or less uniform size. The vacuolated appearance under the low power was due to the disappearance of some or all of the parasitic contents of the host cell. Prolonged search for the characteristic products of asexual multiplication—falciform bodies—brought to light only two or three parasites containing them. It is not to be denied that these may have been moulded into crescent shape by the pressure of the other growing and segmenting members in the same membrane."

From his examination of the material available the author is unable to say whether the parasite is one of the avian coccidia or a foreign organism which failed to survive in an accidental host.

In two small areas in the caeca of the bird the author discovered what appeared to be ordinary bird coccidia in large numbers in the epithelial cells.

The infection is possibly accounted for by the presence of pheasants and other birds around the experimental grounds.

- (123) CARINI (A.) & MACIEL (J.). *Quelques hémoparasites du Brésil.*
[Some Brazilian Haemoparasites.]—*Bull. Soc. Path. Exot.* 1916.
Apr. Vol. 9. No. 4. pp. 247-265.

In this paper the authors describe a number of parasites found in blood smears made from birds. In nearly all cases dry films only were available for examination.

The parasites found include microfilariae, trypanosomes, halteridium, proteosoma, toxoplasma (haemogregarines?).

HELMINTHS.

- (124) YAKIMOFF (W. L.) & Collaborators. *Microfilaires des animaux au Turkestan russe.* [Animal Microfilariae in Russian Turkestan.]—*Bull. Soc. Path. Exot.* 1916. Apr. Vol. 9. No. 4. pp. 219-226.
With 1 plate, comprising 5 figs.

Microfilariae of donkeys.—Parasites have been found in the blood of 19 donkeys out of 847 examined, and the author considers it probable that the species is the same as that occurring in horses in the same area.

Differential counts of the leucocytes in the blood of seven animals from different districts showed that, as in the horse, there was often marked eosinophilia.

Only 46 mules were available for examination, and in one of these microfilariae, also apparently identical with those found in the horse, were discovered.

Microfilariae in Camels.—Of a total number of 1,306 camels examined 117 were found to be infected. The percentage of infected animals varied considerably in different districts, the maximum of 22·5 occurred in the Merve area and the minimum of 0·94 in Taschkent.

Excluding the sheath the parasites ranged from 184 to 226 microns in length. They showed four clear areas.

In addition to the embryos, first stage larvae were often found in which evidence of the differentiation of the alimentary canal could be made out.

Comparative differential leucocyte counts of infected and uninfected camels appeared to indicate that a similar degree of eosinophilia may occur in both, but the possibility is suggested that though microfilariae were absent from the blood other helminths might be responsible for the condition. Comparisons of the measurements given by other authors of microfilariae found in the blood of camels show that the parasite occurring in Turkestan is almost certainly identical with *Microfilaria camelensis* Balfour.

- (125) BOUILLIEZ (M.). *Sur une Filaire du Crapaud de la région du Chari.* [A Filaria of the Toad in the Shari Area.]—*Bull. Soc. Path. Exot.* 1916. Mar. Vol. 9. No. 3. pp. 133-137.

The microfilaria described in this paper has been found by the author on a number of occasions in the blood of the common species of toad

occurring in the Shari area, which he believes to be *Bufo regularis*. He has also been able to find the adult form of the parasite in the peritoneal cavity.

The adult worm is whitish and transparent in the fresh state, and is of practically the same thickness throughout its length. There is no transverse striation, but at places an appearance of longitudinal striation can be made out. The anterior extremity is only slightly attenuated, and shows no papillae. In both sexes the posterior extremity terminates in a blunt point.

The oesophagus is composed of two parts. The first portion is short and narrow and fairly transparent. The second portion is much longer and wider and has a glandular appearance. The intestine is wider than the oesophagus. The excretory pore and the nerve ring have not been definitely localised.

The male is about 30 mm. in length by 170 microns in thickness. The posterior extremity is curved. There are five pairs of genital papillae; three of these are just posterior to the cloaca which is situated 68 microns from the posterior end. The two spicules are unequal in length. The longer is slender and striated at its proximal end as if enclosed in a wrinkled sheath. It terminates in a fine point and appears to have a recurved barb. The shorter one is much thicker and has a thickening at the proximal end shaped much like a human foot. The short spicule is about 125 microns in length, and the long one about three times that length.

The female is nearly twice the size of the male. The tail is rather more slender and not so curved. The anus is situated 275 microns from the posterior end, and the vulva 1.3 mm. from the anterior end. The genital tubes are closely wound round the intestine. The uterus is filled with eggs in various stages of development, the most mature ones measuring 34 microns in length by 30 in width. In preserved material free embryos may be found in the uterus.

The adult parasite has been found in the peritoneal cavity only, and in one instance two of the parasites were found attached to the liver.

Of 62 toads examined only five contained parasites, and seven or eight adults were found in each.

The microfilariae are always numerously present in the blood, and although they are actively motile they do not move about the field. There is apparently no periodicity in the movement.

The parasites measure on an average 150 microns in length by 7 microns in width.

The anterior end of the body appears to be flattened and covered with a thickened cuticle which is very finely denticulated posteriorly. Behind this there is a slight constriction. The caudal extremity although somewhat drawn out does not terminate in an actual point. No striation of the body can be detected, and the sheath of the parasite is very difficult to make out. It appears to be very closely moulded on the parasite.

In stained preparations the column of nuclei is found to be broken at the anterior and the posterior thirds, the other break occurring at the posterior fourth.

- (126) RAILLIET (A.). *Sur les Filaires de Batraciens.* [The Filariae of Reptiles.]—*Bull. Soc. Path. Exot.* 1916. Mar. Vol. 9. No. 3. pp. 137-140.

In this paper the author summarises the Filariae and associated worms that have been described as occurring in reptiles, and comes to the conclusion that the parasite described by BOUILLIEZ (see Abstract No. 125) is probably *F. leiperi*.

Attention is drawn to the fact that whereas this worm has previously been described as occurring in connective tissues, BOUILLIEZ found his parasites in the peritoneal cavity only. This is not considered sufficient to render the classification incorrect.

The arrangement of the genital papillae is said to justify the worm being taken out of the genus *Filaria* and placing it in a genus of which *F. neglecta* is possibly the type.

- (127) LEIPER (R. T.). *On the Relation between the Terminal-Spined and Lateral-Spined Eggs of Bilharzia.*—*Brit. Med. Jl.* 1916. Mar. 18. p. 411.

This short note is published by the author because of the probable delay in the publication of the final portion of his report owing to his absence abroad.

The two principal theories that have been brought forward to explain the occurrence of Bilharzia eggs with the spines in different positions are :—

(a). The terminal-spined eggs are the normal eggs laid by impregnated females, and the lateral-spined eggs are those produced by parthenogenesis (LOOSS).

(b). The constant and peculiar shape of the lateral-spined eggs, their incidence, and their special selection for the intestinal tract, suggest a zoological distinction between the adult worms (MANSON).

Experiments with mice showed that the eggs with terminal spines were always produced by adults developing from cercariae derived from *Bulinus contortus* and *B. dybowskii*, while lateral-spined eggs were always obtained from parasites developing in *Planorbis boissyi*.

The cercariae from the two sources showed small differences in the suckers, the relative length of the tail, and other minute points. Similar differences were found in the adults.

The worms derived from *Bulinus* have four or five large testes and the lateral gut branches are late in uniting. In the female the ovary lies in the posterior half of the body, the uterus is long and voluminous and contains many eggs with terminal spines.

In worms derived from *Planorbis boissyi* the males are small and have eight small round testes. The lateral gut branches unite early. In the female the ovary is in the anterior part of the body, the uterus is short and generally contains only one egg at a time. The eggs always have a lateral spine.

BITING FLIES AND TICKS.

- (128) JOHNSTON (J. E. L.). A Summary of an Entomological Survey of Kaduna District, Northern Nigeria.—*Bull. Entom. Res.* 1916. May. Vol. 7. No. 1. pp. 19–28. With 2 sketch maps.

The author started his survey of the district in August 1914, but was unfortunate in encountering unusual weather conditions. The rainfall was very much below that for the previous year, and this probably accounted for the small number of flies found.

During the whole tour only three tsetse-flies were caught, one *G. tachinoides*, and two *G. palpalis*. It is probable that when the rainfall is heavy the flies come up from the lower parts of the river.

Blood films were made from 150 head of cattle, and 19 were found to be infected with trypanosomes, the parasite present in most of the cases being of the *vivax* type. Thirty-nine animals showed piroplasms in their blood. These were very variable in size. "Some were large pyriform bodies, often with two chromatin dots, or several chromatic granules; some were rings, sometimes extremely minute, sometimes fairly large, showing well-marked chromatin. Occasionally there was a large, more or less confused mass of protoplasm and chromatin, which in some instances could be seen to consist of more than one parasite. Bacillary forms were common, as were thicker forms intermediate between the bacillary and the ring-shaped types. These various types were occasionally seen in one film."

One sheep out of 12 examined showed piroplasms in its blood, but none were found to be infected with trypanosomes.

The paper contains a list of flies and ticks obtained.

- (129) MACGREGOR (M. E.). Resistance of the Eggs of *Stegomyia fasciata* (*Aedes calopus*) to Conditions Adverse to Development.—*Bull. Entom. Res.* 1916. May. Vol. 7. No. 1. pp. 81–85. With 3 text-figs.

In this paper the author details experiments designed to ascertain the conditions under which the eggs of *Stegomyia fasciata* acquire a power of resistance which enables them to remain viable for periods amounting to months.

It was found in the earlier experiments that if eggs laid under conditions supplying plenty of moisture are removed from those conditions within a short time prompt shrinkage takes place and the embryos die. On the other hand it was found that if the eggs are left in contact with moisture for progressively longer periods before they are removed and allowed to become dry a progressively greater number of them remain viable, and that if the eggs are allowed to remain in contact with water for 60 hours or more all the eggs will hatch even after they have been allowed to become thoroughly desiccated.

MISCELLANEOUS.

- (130) DODD (S.). Trefoil Dermatitis, or the Sensitisation of Unpigmented Skin to the Sun's Rays by the Ingestion of Trefoil.—*Jl. Comp. Path. & Therap.* 1916. Mar. Vol. 29. No. 1. pp. 47-62.

The condition described in this paper has been known for some years in certain parts of New South Wales where it has been recognised under the name Aphis disease.

The following are the principal features of the condition. The disease occurs mainly in the spring (August, September and October), when aphides and trefoil are as a rule both abundant. Cattle, sheep, and horses may be affected, but it is only animals in trefoil paddocks that are attacked.

The condition appears in sheep soon after shearing, and the parts affected are the back and loins, ears and nose. Horses and cattle develop the lesions on unpigmented areas of skin only.

The symptoms are: Swelling of the skin with reddening and exudation, irritation resulting in biting and rubbing which lead to the production of raw surfaces.

Although it was a very firmly held opinion that the cause of the disease was aphides, no evidence could be obtained that any one had even seen animals attacked by them. No lesions were ever seen except those involving unpigmented areas of skin, and protection of such areas from sunlight prevented the development of lesions. In some cases in young lambs necrosis of the ears occurred.

The first experiments were carried out with common trefoil, *Medicago denticulata*. Fresh supplies of the plant were obtained and after examination as to freedom from admixture with other plants and fungus of any kind it was used for feeding experiments with guinea-pigs. Three series of experiments were carried out. In the first series guinea-pigs were fed with the plant and exposed to the sun. In the second the feeding was identical, but the guinea-pigs were protected from the sun. In the third the animals were fed upon their ordinary diet and exposed to the sun.

The guinea-pigs of the first group developed erythema of the skin associated with swelling, exudation, and pruritus. In two animals there was necrosis of the ears. The irritation of the skin appeared to be less during the night, but it returned when exposure to sunlight was repeated. Only unpigmented skin was involved, and even this escaped when it was covered with a thick layer of hair.

The symptoms appeared about the sixth day after the commencement of the experiment, and after the trefoil diet was stopped they disappeared slowly at first and then more rapidly.

The guinea-pigs fed upon the same diet, but protected from the direct rays of the sun developed no lesions, nor were any developed in those animals which were fed on their ordinary diet and exposed to the direct rays of the sun.

A similar condition to that above described is produced by the ingestion of buckwheat under the same conditions. It is thought that the green flowering plant is the most active in this connection, but the condition may also be produced by the ingestion of the grain, straw, chaff, or bran.

In this case the exposure to the sun need not occur immediately after the ingestion of the buckwheat, as the skin lesions may develop three or four weeks after plentiful feeding upon the plant.

Preliminary extraction of the buckwheat with alcohol prevents the development of the condition, and the extract obtained produces it.

It appears to be probable that a toxin is responsible for the lesions, especially as brain symptoms are often observed.

In severe cases death may occur in twelve hours or even less.

This condition is termed fagopyrismus.

Reference is also made by the author to the occurrence of the so-called clover disease, which has been recorded in Europe, but apparently not elsewhere.

(131) CLELAND (J. B.). *Experimental Feeding with some Alleged Poison Plants of New South Wales*.—*Agric. Gaz. of N. S. W.* 1914. Jan. 2. pp. 65-69. (Published under the Title Miscellaneous Publication. No. 1714.) 1914. Sydney : Government Printer.

This short paper contains a summary of some experiments carried out with certain plants considered to be poisonous to animals, but it is pointed out that while in some cases negative results were obtained in the experiments it must not be assumed that the plants will not produce toxic effects under other conditions.

Dilleniaceae. *Hibbertia diffusa*.—

This plant was left untouched by rabbits in a rabbit paddock and was therefore suspected. A sheep was given amounts of 2 to 6 ounces almost daily for three months without any ill effects being noted, but it appeared to be invariably fatal to rabbits.

Euphorbiaceae. *Onantherus populifolius*—Native Poplar.—

This plant has been credited with causing redwater.

A calf was given from 10 to 24 ounces daily of fresh leaves, cut up and mixed with other foods for four months without any ill effects being produced.

Léguminosae. *Indigofera australis*.—

This plant has also been credited with causing South Coast redwater in cattle. A calf which was fed almost daily with from 6 to 30 ounces of the leaves showed no ill effects. It is pointed out that occasionally the plant may contain hydrocyanic acid, but it seems certain that it does not contain any other definitely poisonous body in a sufficient amount to cause symptoms.

Santalaceae. *Exocarpus cupressiformis*—Native cherry.—

A sheep fed with the branches of this plant for a period of three months failed to develop any symptoms of cerebral disturbance which the plant has been credited with causing in horses.

Cucurbitaceae. *Cucumis myriocarpus*—Small Wild Melon.—

The repeated administration of a hundred of these fruit to a calf failed to cause any ill effects. The plant is said to have been responsible for blindness in horses in the western parts of New South Wales.

Lobeliaceae. *Lobelia purpurascens*.—

Three rabbits were fed upon this plant, and two of them died. The circumstances suggested that the deaths were not attributable to the plant, especially as one of them ate about three ounces daily for three months without any ill effect.

Cycadaceae. *Macrozamia spiralis*.—

Numerous references have been made to this plant as a cause of rickets, and some years ago STEWART claimed to have produced the disease by feeding about two pounds daily to cattle.

A cow was given one pound of cut up leaflets together with nourishing food for six months. No evidence of disease was produced. The author thinks that in very poor country cattle may eat the plant, and that any symptoms produced are not due to the plant but to some deficiency in the diet which is little more than sufficient to prevent starvation.

Liliaceae. *Xanthorrhoea* sp.—Grass-tree.—

This plant was at one time thought to be responsible for unthriftiness and, eventually, paralysis, the symptoms being caused by a resin contained in the young shoots, which appeared to be especially dangerous after rain.

A calf which was fed almost daily for five months with from one to two pounds of young shoots and flowering stems failed to develop any signs of the disease.

- (132) CROPPER (J. W.) & DREW (A. H.). The Occurrence of Bodies resembling "Seidelin Bodies" (*Paraplasma flavigenum?*) in Anaemic and Foetal Blood, with Some Remarks on their Probable Nature.—*Jl. Trop. Med. & Hyg.* 1916. Jan. 15. Vol. 19. No. 2. pp. 20-24. With 1 plate, comprising 25 figs.

Conclusions:—

"(1) The blood in pernicious anaemia and that of the human foetus and of new-born kittens contains bodies which appear identical with Seidelin bodies (*Paraplasma flavigenum*, the so-called parasite of yellow fever).

"(2) The bodies are apparently absent in the blood of normal and ordinarily anaemic adults. They may rarely be found in the blood of anaemic children.

"(3) The bodies are the remnants of the nuclear degeneration (Schilling-Torgau) which takes place in the conversion of the erythroblast into the normal non-nucleated red corpuscle.

"(4) The red-staining granules are readily demonstrated by the jelly method of *in vitro* staining and are probably centrosomes."

- (133) ROUS (P.) & TURNER (J. R.). The Preservation of Living Red Blood Cells in Vitro. I. Methods of Preservation.—*Jl. Experim. Med.* 1916. Feb. Vol. 23. No. 2. pp. 219-237.

Apart from the theoretical interest attaching to experiments designed to perfect methods of preserving living red corpuscles *in vitro*, the authors point out that such methods might be of considerable practical value, as they could be used for serum reactions, culture media, and even for transfusion.

The authors detail the experiments carried out in connection with the causes of haemolysis occurring in corpuscles washed in the ordinary way, and methods of preventing this. They also deal with procedures devised for the preservation of such corpuscles outside the body so that they retain their physiological characters.

The results are summarised as follows :—

"The erythrocytes of some species are much damaged when handled in salt solutions, as in washing with the centrifuge after the ordinary method. The injury is mechanical in character. It may express itself in hemolysis only after the cells have been kept for some days. It is greatest in the case of dog corpuscles, and well marked with sheep and rabbit cells. The fragility of the red cells, as indicated by washing or shaking them in salt solution is different, not only for different species, but for different individuals. It varies independently of the resistance to hypotonic solutions.

"The protection of fragile erythrocytes during washing is essential if they are to be preserved *in vitro* for any considerable time. The addition of a little gelatin ($\frac{1}{2}$ per cent.) to the wash fluid suffices for this purpose, and by its use the period of survival in salt solutions of washed rabbit, sheep, and dog cells is greatly prolonged. Plasma, like gelatin, has marked protective properties.

"Though gelatin acts as a protective for red cells it is not preservative of them in the real sense. Cells do not last longer when it is added to the fluids in which they are kept. Locke's solution, though better probably than Ringer's solution, or a sodium chloride solution, as a medium in which to keep red cells, is ultimately harmful. The addition of innocuous colloids does not improve it. But the sugars, especially dextrose and saccharose, have a remarkable power to prevent its injurious action, and they possess, in addition, preservative qualities. Cells washed in gelatin-Locke's and placed in a mixture of Locke's solution with an isotonic, watery solution of a sugar remain intact for a long time,—nearly two months in the case of sheep cells. The kept cells go easily into suspension free of clumps, they pass readily through paper filters, take up and give off oxygen, and when used for the Wassermann reaction behave exactly as do fresh cells of the same individual. The best preservative solutions are approximately isotonic with the blood serum. If the cells are to be much handled gelatin should be present, for the sugars do not protect against mechanical injury.

"Different preservative mixtures are required for the cells of different species. Dog cells last longest in fluids containing dextrin as well as a sugar. The mixture best for red cells is not necessarily best for leukocytes.

"A simple and practical method of keeping rabbit and human erythrocytes is in citrated whole blood to which sugar solution is added. In citrated blood, as such, human red cells tend to break down rather rapidly, no matter what the proportion of citrate. Hemolysis is well marked after little more than a week. But in a mixture of three parts of human blood, two parts of isotonic citrate solution (3·8 per cent. sodium citrate in water), and five parts of isotonic dextrose solution (5·4 per cent. dextrose in water), the cells remain intact for about four weeks. Rabbit red cells can be kept for more than three weeks in citrated blood; and the addition of sugar lengthens the preservation only a little. The results differ strikingly with the amount of citrate employed. Hemolysis occurs relatively early when the smallest quantity is used that will prevent clotting. The optimum mixture has three parts of rabbit blood to two of isotonic citrate solution.

"In the second part of this paper experiments are detailed which prove that cells preserved by the methods here recorded function excellently when reintroduced into the body."

(134) ROUS (P.) & TURNER (J. R.). **The Preservation of Living Red Blood Cells in Vitro. II. The Transfusion of Kept Cells.—*Jl. Experim. Med.* 1916. Feb. Vol. 23. No. 2. pp. 239-248.**

Summary :

"In order to determine the availability for functional uses of red cells kept *in vitro* by our methods, transfusion experiments have been carried out with rabbits by which a large part of their blood was replaced with kept rabbit cells suspended in Locke's solution. It has been found that erythrocytes preserved in mixtures of blood, sodium citrate, saccharose,

and water for 14 days, and used to replace normal blood, will remain in circulation and function so well that the animal shows no disturbance, and the blood count, hemoglobin, and percentage of reticulated red cells remain unvaried. Cells kept for longer periods, though intact and apparently unchanged when transfused, soon leave the circulation. Animals in which this disappearance of cells is taking place on a large scale, remain healthy save for the progressing anaemia. The experiments prove that, in the exsanguinated rabbit at least, transfusions of cells kept for a long time *in vitro* may be used to replace the blood lost, and that when the cells have been kept too long but are still intact they are disposed of without harm. The indications are that kept human cells could be profitably employed in the same way.'

- (135) FUTAKI (K.), TAKAKI (F.), TANIGUCHI (T.) & OSUMI (S.). The Cause of Rat-Bite Fever.—*Jl. Experim. Med.* 1916. Feb. Vol. 23. No. 2. pp. 249-250. With 1 plate.

The authors have encountered four cases of the disease, and in two of them have been able to make detailed investigations.

All the cases presented symptoms which are typical of the disease. The period of incubation is from 10 to 27 days, and the first symptoms are fever and headache. Inflammation occurs around the bites, pains occur in the limbs, a dark red skin eruption appears, and there is swelling of the lymphatic glands. The high fever and the local lesions continue for from three to seven days, and alternate with afebrile intervals of two to three days.

A piece of skin was obtained with precautions to ensure sterility from the first case investigated, and with dark ground illumination spirochaetes were discovered. Monkeys, guinea-pigs, and white rats inoculated with materials from the tissues and with blood all became infected.

Indian ink preparations of gland juice from the second patient and a piece of gland impregnated with silver nitrate also showed spirochaetes.

The parasite was larger than *Sp. pallida*, and smaller than the parasites of relapsing fever.

The patients were treated with mercury and salvarsan respectively and both recovered.

The conclusion drawn is that the organism is probably the cause of the condition.

- (136) TRIBONDEAU (L.), FICHET (M.) & DUBREUIL (J.). Procédé de coloration des liquides organiques et leurs parasites. [A Method of Staining Organic Liquids and Parasites contained in them.]—*C.R. Soc. Biol.* 1916. Apr. 1. Vol. 79. No. 7. pp. 282-287.

This paper contains directions for the preparation and use of a compound dye the component parts of which are all of French manufacture. The method is based upon the use of eosinate of silver, methylene blue and eosinate of ordinary methylene blue.

- (137) MUIR (R.). Staining of Bacterial Capsules in Films and Sections.—*Jl. Path. & Bact.* 1916. Jan. Vol. 20. No. 3. pp. 257-259. With 1 plate, comprising 2 figs.

It is claimed for the method described in this paper that the capsules of bacteria can be differentially stained while a Gram-positive reaction is also obtained. Close adherence to the steps is enjoined.

Method applied to film preparations :—

(a). Dry film.—A thin film of the material is made on a cover glass and after becoming dry in the air it is fixed by placing in saturated watery sublimate solution for one minute. The preparation is then washed in water and in methylated spirit. (b). Wet film.—A cover glass carrying a thin moist film is placed film side downwards in 10 per cent. formalin for two to five minutes. It is then gently washed with water and methylated spirit.

The film is covered with freshly prepared Gram's stain of the following composition :—

Saturated alcoholic gentian violet	1 part.
5 per cent. watery carbolic acid	5 parts.

The preparation is heated gently over a Bunsen for a few minutes. When cool the stain is washed off with Gram's iodine and a little fresh iodine solution is added. After two or three minutes the iodine is washed off with methylated spirit and the washing with spirit is repeated.

A few drops of clove oil are then placed on the film and the warming is repeated. Wash with spirit and then with water.

Filter on the film a few drops of a solution containing one part each of a saturated watery solution of sublimate, a saturated watery solution of potash alum, and a 20 per cent. solution of tannic acid. This is allowed to act for five minutes. Wash in water and counterstain for one or two minutes with a saturated watery solution of eosin. Wash in water. Filter on a few drops of saturated watery solution of potash alum and allow to act for a minute. Then wash, dry, and mount, or, in the case of wet-fixed films, dehydrate, clear in benzol, and mount.

Method applied to sections.—Small pieces of tissue should be fixed in 5-10 per cent. formalin for two or three days, and after a few minutes washing should be transferred to methylated spirit for two or three days to complete the hardening.

For the removal of the precipitate which frequently forms in formalin fixed material the pieces should be placed in a solution containing one part of 1 per cent. watery caustic potash and 20 parts of 80 per cent. alcohol. The removal of the precipitate is slow and requires a week or more.

Thoroughly wash for several hours in running water, and replace in methylated spirit where the pieces may be kept until required. Embed the tissues in the usual way.

The method of staining sections is identical with that described for films except that the specimen may not require heating after the clove oil is placed upon it, and in any case heating need not be prolonged beyond a few seconds in order to complete the decolourisation, and that the alcohol used for the dehydration should contain four drops of glacial acetic acid to the ounce.

(138) KRAUSS (W.) & FLEMING (J. S.). A Concentration Method for the Diagnosis of Malaria.—*Southern Med. Jl.* 1916. Feb. Vol. 9. No. 2. pp. 141-144.

For the method described in this paper it is claimed that it can be used by the general practitioner and by the field worker, greater

concentration is obtained than by other methods, practically all the cellular elements are removed, and the parasites are well preserved and stain well.

For taking the blood sterile bottles with rubber stoppers and of about 30 cc. capacity have placed in them about 20 cc. of 85 per cent. salt solution containing 2 per cent. sodium citrate. A 2 cc. syringe is first charged with 0·5 cc. of this solution, and is then filled with blood from a vein. The contents are then ejected into one of the bottles.

Formalin is then added to the mixture. A series of charts shows the effects both with regard to haemolysis and fixation of the parasites produced by various concentrations of formalin acting for different lengths of time. If the fixation be too rapidly carried out haemolysis may be prevented. The quantity of formalin added apparently depends upon the time that will elapse before the specimen is examined ; the longer the time the smaller the amount of formalin required. The liquid is then centrifuged until all the cells are thrown down. The supernatant liquid and the leucocyte cream are removed. Distilled water is introduced into the tube and the cells are haemolysed. After further centrifuging smears are made of the deposit and stained. It is recommended that if commercial formalin is used it should be carefully neutralised with sodium hydrate. Similarly the reaction of the citrate solution may have to be corrected. This is done to avoid rewashing which is a cause of failure.

As a guide to the amount of formalin required it is said that if the blood is to be sent from a distance it is as well to add such an amount of formalin as will fix the parasites in from 24 to 48 hours, i.e., by adding two drops of 10 per cent. formalin solution (37 per cent. formaldehyde) to every 10 cc. of citrated blood.

The method of staining advised is not specified in this paper.

- (139) RETTERER (Éd.) & NEUVILLE (H.). *De la rate des Camelidés, des Girafidés, et des Cervidés.* [The Spleen of the Camelidae, the Girafidae, and the Cervidae.]—*C. R. Soc. Biol.* 1916. Feb. 5. Vol. 79. No. 3. pp. 128-131.

The Camelidae.—

Llama guanaco.—The spleen is crescent-shaped, measuring about 17 centimetres in length. The right extremity is about 6 centimetres wide, and the left about half that. The left and hinder border is the convex one. The external surface is convex, and is not attached to the diaphragm in any way.

The spleens of the llama (*Auchenia glama*) and the alpaca (*Auchenia paco*) closely resemble that above described.

In the camel (*Camelus bactrianus*) when about one month old the spleen very much resembles that of the llama in general form, but is about twice as wide as its extremities. The borders may show superficial clefts.

The Girafidae.—In the giraffe (*Giraffa camelopardalis*) the spleen when in position is somewhat bell- or dome-shaped. The concave surface encloses the highest part of the rumen, and the convex surface engages with the diaphragm. Although the animal whose spleen was examined had not attained its full growth the spleen measured 35 centimetres in length, 20 in width, and had a maximum thickness of 7 centimetres.

The diaphragmatic surface of the organ is adherent to the diaphragm for at least half its extent, the only free portions being the left extremity and the ventral portion. On the visceral surface the spleen is attached to the stomach over the right two-thirds of its area.

Tragulidae. *Tragulus meminna* Erxl.—The spleen of the adult is practically oval in shape and measures 5 centimetres in length by 2 in width. Its right extremity is pointed, and the organ is thickest at its dorsal edge where the thickness is about 4 mm.

Cervidae. *Cervus axis* Erxl.—The spleen is flattened and measures about 4 centimetres by 2·5. The left extremity is pointed. The diaphragmatic surface is attached to the diaphragm in the dorsal third, but the right extremity is quite free. The visceral surface is connected to the stomach by dense connective tissue.

Cervulus muntjac Zimm.—The spleen is 8 centimetres long and 4 wide. The left extremity is narrower than the right. Both the borders are convex, and the splenic artery and vein enter and leave the organ at a prominence situated about the middle of the dorsal edge. The spleen is attached to the diaphragm over half the parietal surface and to the stomach over the dorsal third of its visceral surface.

Cervus capreolus L.—The spleen of a still-born subject was found to be 2 centimetres in length and 1·3 in width.

(140) CHATTON (E.) & BLANC (G.). *Cryptoplasma rhipicephali* n. g., n. sp., protiste endoparasite de la Tique, *Rhipicephalus sanguineus*, du Gondi: *Ctenodactylus gundi*. [*Cryptoplasma rhipicephali* n. g., n. sp., Endoparasitic Protozoon of *Rhipicephalus sanguineus* from the Gondi.]—*C. R. Soc. Biol.* 1916. Feb. 5. Vol. 79. No. 3. pp. 134–138. With 2 text-figs.

The authors have found the parasite described in this paper in stained preparations made from a single nymph only out of about 100 examined. They have not observed it in the living condition, nor have they been able to determine in what organ or organs of the tick the parasite occurred. But the number of parasites found was so great that probably only the body cavity or a greatly distended intestine could have been capable of containing them.

All the parasites found were morphologically the same. They were slightly bowed structures about 55 microns in length and 5 in diameter at the thickest part, which was quite close to one end. One end was generally more pointed than the other. The body appeared to be quite unstained, but there was a fibrillated band of chromatin-like substance which made one spiral twist apparently around the outside of the body. The outer surface was quite smooth.

At the edges of the smears there were certain parasites which through rapid drying had undergone shrinkage which seemed to have resulted in the rupture of the wall, resulting in penetration of the stains. In these parasites the cytoplasm was coarsely granular, the granules in some cases being arranged in spiral coils. No nuclear structure could be definitely made out.

In some of the shrunken parasites it could be clearly made out that the chromophile spiral already referred to was closely applied to the outside of the unstained shell-like structure which enclosed the cytoplasm.

The authors suggest that the elongated structure represents a parasite, and the outer spiral of chromatin-like material represents the remains of the nucleus of a host cell. In support of this view they give a figure of a haemogregarine of the gecko (which is probably a new species) enclosed in the remains of a red corpuscle.

With regard to the apparent absence of a nucleus in the parasite, two suggestions are put forward. One is that the thickness of the shell prevents it from staining by the technique employed, and the other is that the nucleus is diffuse as in the Cyanophyceae.

The authors have not sufficient material upon which to base any idea of the classification of the parasite observed, but they are inclined to exclude it as a stage of *Piroplasma quadrigeminum* or *Toxoplasma gondii*.

(141) CHATTON (E.) & BLANC (G.). Un pseudo-parasite *Cryptoplasma rhipicephali* Chatton et Blanc. [A Pseudo-Parasite *Cryptoplasma rhipicephali*.]—*C. R. Soc. Biol.* 1916. May 20. Vol. 79. No. 10. pp. 402.

In the above journal of the date January 22, 1916, the authors published an account of an organism which they had found in immense numbers in the body of a tick, *R. sanguineus*. Only a single tick was found to contain the organisms and only a stained preparation was available for examination. According to the records the tick in which they were found was a nymph, and it is noted that the description was written eighteen months after circumstances had compelled the authors to stop their investigations. Apparently an error had crept into the records with regard to the stage of the tick in which the structures were found, as subsequent investigations carried out with male ticks shewed that the bodies were in reality spermatozoa, and that therefore the tick originally examined must have been a male.

REPORTS.

(142) ACCRA LABORATORY. Annual Report for 1914. [MACTIE (J. W. Scott).] 56 pp. F'cap. Illustrated. 1915. London: J. & A. Churchill, 7, Great Marlborough Street. [Price 5s.]

In referring to a number of abnormalities observed in blood films on different occasions the author states that in a number of tame mice brought from England all of which died soon after arrival, the only constantly observed phenomenon was the presence of immense numbers of platelets in the blood.

In the blood of cattle and sheep platelets sometimes presented extraordinary shapes. Some were like spirochaetes with a thickening in the centre.

It is stated that anaplasma-like bodies were very frequently found in the blood of men and animals. While such bodies were not specially sought for a note was kept of the number of smears in which they were present in conspicuous numbers. Except in the case of the pig, in which they were present in 33 per cent. of the samples of blood examined, no idea as to the frequency of occurrence in other species can be formed, as only the number of smears containing them is given, without the total number examined. In addition to cattle, humped and straight-backed, sheep, pigs, and goats, monkeys, bats, donkeys, hedgehogs, cats, brown, black and pouched rats, mice, and guinea-pigs also showed them in their blood.

A coarse basophilia of the red cells was a marked feature of the blood of cattle, especially those infected with trypanosomes.

Trypanosomiasis and piroplasmosis are dealt with, but these subjects have received a more extended notice in a paper published in the *Ann. Trop. Med. & Parasitol.*, 1915. Dec. [see this *Bulletin*, Vol. 4, No. 1, pp. 6-9].

Spirochaetes were found on a number of occasions in blood films from cattle, sheep, pigs, and goats, but as the films were made at the slaughter-house the possibility is not excluded that some of them were contaminated.

The parasites found appeared to fall into four groups.

In the first group the parasites measured about 7 by 0·13 microns, and usually showed two spirals.

The second group included parasites of about the same size as the foregoing, but showing four spirals.

The third group contained parasites about 11 microns in length by 0·2 in width. These generally showed five irregular spirals and stained rather unevenly.

The parasites of the fourth group were as long, but rather thicker than those in the third group. They showed three spirals, and sometimes contained dark-staining granules.

Spores of *Sarcocystis* were found in the blood of cattle, sheep, and a pig. The author considers that the presence of these parasites in the blood was presumably in the nature of a contamination from the tissues of the neck, although he failed to find sarcocysts in the muscles of the neck.

In one of the cattle the spores appeared to be rather different from those found in the other animals. The pink-staining area usually present at the more pointed end was absent, and the chromatin granules forming the nucleus were more closely compacted than usual.

Filariae were found in the blood of cattle, but not in sheep, pigs, or goats. They were present in very small numbers and all appeared to belong to the same species. They were enclosed in an ample sheath. The average length was 144 microns, and the breadth 6 microns. At

the rounded cephalic extremity there was a clear area measuring about 6 microns, and at the tapering hind extremity a similar area measuring about 12 microns. In all of them there was a break in the continuity of the cells, the middle point of which was about 30 microns from the anterior end.

In the mesentery of one adult hump-backed ox an adult specimen of *Setaria labiat-a-papillosa* was found.

The author has found *T. pecaudi* in a large proportion of the horses and mules examined by him, and in two cases *T. vivax*. Although *Glossina* does not appear to breed in the immediate neighbourhood of the town they are occasionally introduced from outside through the medium of trains and motor wagons. One of the difficulties of eliminating trypanosomiasis from the horses and mules lies in the fact that cattle harbouring the parasites are allowed to wander about the streets, and thus form a reservoir for the infection of horses which is effected mechanically by *Stomoxys* and other genera of biting flies.

Filarial embryos were found in the blood of one horse. These were devoid of a sheath and measured about 160 microns in length by 5 in width.

In the fur of pouched rats a parasite *Heminerus talpoides*, which according to MARSHALL may be described as "an aberrant cockroach that has taken to a parasitic mode of life," was found.

An outbreak of spirochaetosis among fowls and ducks was cut short by the intramuscular administration of 1/10 grain of atoxyl, all the birds resisting infection save one which was cured by a second injection.

No ticks could be found on the birds, but *Echidnophaga gallinaceus* was present in large numbers, and in view of the positive result recorded by MAYER of transmitting spirochaetes to canaries by this flea, an attempt was made to confirm it. The result was negative, but the fowl used was a native-bred one and the experiment was therefore not satisfactory and was only made on the chance that the bird might be susceptible.

Haemogregarines were found in the blood of snakes, toads, and lizards. The latter appeared to be far less heavily and frequently infected than was the case at Yaba, Nigeria.

(143) NIGERIA. Annual Report. Medical Research Institute. 1914.

[CONNAL (A.) & COGHILL (H. S.)] 22 pp. F'cap. 1916. London:
Published by the Crown Agents for the Colonies. [Price 2s. 6d.]

The results of the work carried out in connection with yellow fever have been reported to the Yellow Fever (West Africa) Commission, but a synopsis is given in the present report. From this the following points may be gathered.

The disease has been transmitted to guinea-pigs in series by sub-cutaneous and intraperitoneal inoculation. In inoculated guinea-pigs the period of incubation ranged from a few hours to two days, and the period of illness varied from a few days to several weeks. Collapse sometimes occurred in the acute stages, but in the more chronic cases there were progressive weakness and emaciation, and staring of the coat. Albumen was always present in the urine except in the early stages of the disease.

At the post-mortem haemorrhages and erosions of the gastric mucous membrane, petechiae in the pericardium and pleurae, and congestion of the liver were noted.

"*Paraplasma flavigenum*" was present in the blood constantly, sometimes within a day of inoculation, and remained there during the whole course of the disease and during the early part of the period of convalescence.

Impression preparations from the lungs, liver, and spleen show intra- and extra-corpuscular bodies which were thought to be "advanced forms" of "*P. flavigenum*."

All attempts to obtain cultures by Bass's and Ziemann's methods failed.

Two monkeys were inoculated from infected guinea-pigs. A short febrile reaction resulted and "*Paraplasma flavigenum*" was found in the blood for a few days after the injection. A piece of spleen excised from one of them also showed the form of parasite found in the lungs, spleen, and liver of the guinea-pigs.

With a view to controlling results observations were carried out on apparently healthy guinea-pigs. Structures indistinguishable from *Paraplasma* were found in the blood of a number of them. The injection of their blood into other guinea-pigs failed to give rise to any febrile reaction. Albumen was never found in the urine, but in some cases petechiae were found in the mucous membrane of the stomach and there was congestion of the kidneys or even nephritis.

Some apparently healthy and normal guinea-pigs which died from unascertained causes showed petechiae in the stomach, acute inflammatory conditions in the kidneys, and albuminuria.

Reference has previously been made [see this *Bulletin*, Vol. 2, p. 143] to the discovery by CONNAL of malarial parasites in the blood of monkeys. The first three received were all found to be infected, but of fourteen afterwards examined only one showed parasites.

Two attempts to cultivate the parasite by Bass's and Ziemann's methods apparently failed, no division forms being observed in either case.

Experiments were carried out with *Stegomyia fasciata*, *Culiciomyia nebulosa*, *Ochlerotatus irritans*, *O. nigriceps*, and *Anopheles costalis*, but in no case were any developmental forms found in the mosquitoes, nor did any of the clean monkeys become infected.

Intramuscular injections of quinine failed to cause a disappearance of the parasites.

Numerous active flagellates resembling *Trichomonas* were present in blood and mucus passed by goats suffering from dysentery, of which there was an epidemic at Yaba.

In the blood of 12 out of 126 pigs *T. pecorum* was found. Seven out of 22 dogs were found to be infected with a trypanosome of the *brucei* type.

T. vivax was found to be present in a large proportion of a herd of cattle brought down from the Northern Provinces. About 30 per cent. of them also showed *Babesia* (species not stated) in their blood. Three

were put under treatment with salvarsan or atoxyl, but in no case was a cure effected. The animals were in advanced stages of the disease when treatment was started. The drugs appeared to cause some diminution in the number of Babesia present.

The authors mention the discovery of Babesia in the blood of a pig, but give no details.

Two experiments in the cultivation of *Theileria* were made by Bass's method with the blood of a cow showing the parasites in small numbers as follows :—

"Bass culture of *Theileria* No. 1.—Bass cultures were made from one of the animals in the usual way, the incubation temperature being 40° C. The parasite, following Castellani and Chalmers (*Manual of Tropical Medicine*, 1913, p. 368), was *Theileria* (cytoplasm easily visible, division in fours, nucleus without dimorphism, bacillary forms present).

"Cow No. 17, which was the animal from which the blood was taken for cultivation, showed a somewhat scanty infection with *Theileria*. Most of the forms of the parasite were minute and rounded, only a few bacillary forms being seen. No trypanosomes were found. After five hours' incubation there were seen in addition to bacillary, rounded, pear-shaped and vibrio-shaped forms, a number of rounded bodies which contained four chromatin masses, arranged for the most part in the form of a cross,

thus . . . , but in a few instances arranged thus . . . , whilst other parasites contained only two chromatin masses. At 10 hours the forms dividing into four were more numerous, and the other forms had grown more rounded. It was also observed that the bacillary forms were thicker and more like a cocco-bacillus. At 13 hours the four chromatin dots had separated and there was evidence of separate cytoplasm around each mass of chromatin. At 20 hours, whilst there were still a few of the parasites which showed the early stage of the division of chromatin, in most cases the bodies were widely separated, and many erythrocytes were seen to contain four, six or eight minute *Theileria*, whilst other red cells had evidently become freshly infected with single or multiple young spores. At 23 hours the smears showed mostly larger spherical and bacillary forms, and few bodies in a state of division. At 28 hours again there was a much larger proportion of dividing forms. At 32 hours the chromatin masses in the dividing forms were beginning to separate. At 38 hours most of the forms were separate and non-dividing, sometimes three and sometimes four babesiae being present in one cell, but for the most part only one or two in each infected corpuscle. At 44 hours large pear-shaped and spherical forms were most numerous. At 50 hours there were again a few dividing forms, and a number of the single forms were swollen and apparently degenerated. At 61 hours freshly dividing forms were still present, but for the most part the parasites were large, with a single nucleus pear-shaped and spherical forms predominating, with only a few bacillary forms.

"Bass cultures of *Theileria* No. 2.—The same procedure was repeated with blood from the same cow, on the day following the first experiment. After two hours' incubation, spherical and bacillary forms of the parasite predominated, and the *Theileriae* were mostly single in the host cell. At four hours the appearances were the same as before, but a few dividing forms had appeared. A few trypanosomes were also observed for the first time, and erytrophagocytosis had taken place to a slight extent. At six hours, many dividing forms were observable, most of them with four chromatin divisions. At eight hours the red blood corpuscles showed a large infection with small spores, dividing forms were few, large spheres and bacillary forms being still numerous. There was mostly one or at most two parasites in each infected cell. At 14 hours the great majority of the red cells were infected, some containing large single forms in addition to dividing forms. All stages of the parasite were seen, rings, pears, spheres, bacillary and cocco-bacillary forms. At 16 hours the individuals resulting from the dividing forms were mostly separate, and each with its cytoplasm

distinct. At 18 hours there was again a large number of forms in the early stages of division. At 20 hours these dividing forms had completed the process, many red cells showing a fresh infection with young parasites. At 31 hours there were as a rule two or three parasites in each infected cell, and most of the forms were large, bacillary and pear-shaped being the commonest. At 40 hours single forms of medium size predominated. At 44 hours the individual parasites were larger, and there were a few new division forms. Some swollen and degenerating parasites were noted. At 48 hours there was again a fair number of fresh corpuscles newly infected, but degenerative signs were more marked. At 61 hours a large proportion of the parasites was degenerated.

"The cultivation of the parasite enabled its nature to be established with more certainty than could have been done by examination of smears from the peripheral blood.

"Schizogony took place several times during the first 48 hours; thereafter degenerative changes set in.

"It would appear that the fine bacillary or vibrio-shaped forms grew into the more swollen coco-bacillary parasites which did not show any division of the chromatin. Presumably these were the gametocytes. Attempts to transmit the infection to guinea-pigs by intraperitoneal and subcutaneous inoculation failed."

The paper contains lists of the mosquitoes, flies, ticks, and helminths collected.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 4, No. 1, pp. 47-49.]

Leishmaniasis.

- (144) BOUILLEZ (M.). Un cas de Kala-azar infantile au Moyen-Chari (Territoire du Tchad). [A Case of Infantile Kala-azar at Moyen-Chari (Chad Territory).—*Bull. Soc. Path. Exot.*, 1916. May. Vol. 9. No. 5. pp. 299-302. With 1 text-fig.]
- (145) ESCOMEL (E.). Contribution à l'étude de la Leishmaniose américaine (Laveran et Nattan-Larrier), Formes et variétés cliniques. [Clinical Varieties of American Leishmaniasis.]—*Bull. Soc. Path. Exot.*, 1916. Apr. Vol. 9. No. 4. pp. 215-219.
- (146) ROGERS (L.) & HUME (N. H.). The Treatment of Kala-azar (Indian Form) by Tartar Emetic intravenously and by Inunctions of Metallic Antimony.—*Brit. Med. Jl.*, 1916. Feb. 26. pp. 301-303.

Spirochaetosis.

- (147) FANTHAM (H. B.). Spirochaetes and their Granule Phase.—*Brit. Med. Jl.*, 1916. March 18. pp. 409-411.
- (148) NOGUCHI (H.). Certain Alterations in Biological Properties of Spirochaetes through Artificial Cultivation.—*Ann. Inst. Pasteur*, 1916. Jan. Vol. 30. No. 1. pp. 1-4.

Biting Flies and Ticks.

- (149) d'ANFREVILLE (L.). Les Moustiques de Salé, Maroc. [The Mosquitoes of Salé, Morocco.]—*Bull. Soc. Path. Exot.*, 1916. Mar. Vol. 9. No. 3. pp. 140-142. With 6 text-figs.
- (150) LAMBORN (W. A.). Third Report on Glossina Investigations in Nyasaland.—*Bull. Entom. Res.*, 1916. May. Vol. 7. No. 1. pp. 29-50.
- (151) LLOYD (L.). Report on the Investigation into the Bionomics of *Glossina morsitans* in Northern Rhodesia, 1915.—*Bull. Entom. Res.*, 1916. May. Vol. 7. No. 1. pp. 67-79. With 2 text-figs. and 1 plate comprising 2 figs.
- (152) TURNER (R. E.). On Mutillidae Parasitic on *Glossina morsitans*.—*Bull. Entom. Res.*, 1916. May. Vol. 7. No. 1. pp. 93-95. With 2 text-figs.

Helminths.

- (153) PRATT (H. S.). The Trematode Genus *Stephanochasmus* Looss in the Gulf of Mexico.—*Parasitology*, 1916. Jan. Vol. 8. No. 3. pp. 229-238. With 1 plate comprising 10 figs.
- (154) RAILLIET (A.) & HENRY (A.). Sur les Oxyuridés. [The Oxyuridae.]—*C. R. Soc. Biol.*, 1916. Feb. 5. Vol. 79. No. 3. pp. 113-115.
- (155) RAILLIET (A.) & HENRY (A.). Nouvelles remarques sur les Oxyuridés. [New Remarks regarding the Oxyuridae.]—*C. R. Soc. Biol.*, 1916. Apr. 1. Vol. 79. No. 7. pp. 247-250.
- (156) RAVENNA (E.). Sulla tossicità dei liquidi parassitari.—Ricerche sperimental. [The Toxicity of Liquids obtained from Parasites. Experimental Researches.]—*Jl. Mod. Zootro. Parte Scientifica*, 1916. Mar. 31. Vol. 27. Ser. 5. (Vol. 3.) No. 3. pp. 61-84.
- (157) SEURAT (L.-G.). Sur les Oxyures des Mammifères. [The Oxyurides of Mammals.]—*C. R. Soc. Biol.*, 1916. Jan. 22. Vol. 79. No. 2. pp. 64-68. With 3 text-figs.

- (158) SEURAT (L.-G.). Sur l'habitat normal et les affinités du *Protospirura numidica* Seur. [The Normal Habitat and the Affinities of *Protospirura numidica* Seur.]—*C. R. Soc. Biol.*, 1916. Feb. 5. Vol. 79. No. 3. pp. 143-146. With 4 text-figs.
- (159) SEURAT (L.-G.). Sur l'habitat normal et les affinités du *Rictularia proni* Seur. [The Normal Habitat and the Affinities of *Rictularia proni*.]—*C. R. Soc. Biol.*, 1916. Feb. 5. Vol. 79. No. 3. pp. 146-149. With 2 text-figs.

Protozoa.

- (160) CHATTON (E.) & BLANC (G.). Précisions sur la Morphologie de l'hématozoaire endoglobulaire de la Tarente: *Pirhemocytion tarentolae* Chatton et Blanc. [Details of the Morphology of the Intracorporeal Parasite *Pirhemocytion Tarentolae*.]—*C. R. Soc. Biol.*, 1916. Jan. 22. Vol. 79. No. 2. pp. 39-43. With 1 text-fig.
- (161) SANGIORGI (G.). Di un Coccidio parassita del Rene della Cavia. [A Coccidium Parasitic in the Kidney of the Guinea-pig.]—*Pathologica*, 1916. Feb. 15. Vol. 8. No. 175. pp. 49-53.

Miscellaneous.

- (162) CONOR (M.). Les invasions de Sauterelles en Afrique Mineure (Figurations et Textes anciens). [The Invasions of Locusts in Africa (Ancient References).]—*Arch. Inst. Pasteur Tunis*, 1916. Apr. Vol. 9. No. 3. pp. 149-156. With 1 plate and 1 text-fig.
- (163) COSCO (G.) & ANGELO (A.). La Virulenza del Sangue degli Animali malati di Afta epizootica. [The Virulence of the Blood of Animals affected with Foot and Mouth Disease.]—*Clinica Vet.*, 1916. Apr. 15. Vol. 39. No. 7. pp. 193-195.
- (164) HALL (J. C.) & STONE (R. V.). The Diphtheroid Bacillus of Preisz-Nocard from Equine, Bovine, and Ovine Abscesses. Ulcerative Lymphangitis and Caseous Lymphadenitis.—*Jl. Infect. Dis.*, 1916. Feb. Vol. 18. No. 2. pp. 195-208.
- (165) d'HERELLE (F.). Campagne contre les *Schistocerca peregrina* en Tunisie par la méthode biologique. [Campaign against Locusts in Tunis on Biological Lines.]—*Arch. Inst. Pasteur Tunis*, 1916. Apr. Vol. 9. No. 3. pp. 135-148.
- (166) KOLMER (J. A.) & SMITH (A. J.). The Bactericidal and Protozoacidal Activity of Emetin Hydrochloride in Vitro.—*Jl. Infect. Dis.*, 1916. March. Vol. 18. No. 3. pp. 247-265.
- (167) KOLMER (J. A.) & SMITH (A. J.). The Bactericidal and Protozoacidal Activity of Emetin Hydrochloride in Vivo.—*Jl. Infect. Dis.*, 1916. Mar. Vol. 18. No. 3. pp. 266-276.
- (168) RETTERER (E.) & NEUVILLE (H.). De la rate du Rhinocéros et du Tapir. [The Spleen of the Rhinoceros and of the Tapir.]—*C. R. Soc. Biol.*, 1916. Apr. 1. Vol. 79. No. 7. pp. 267-270.
- (169) RIES (J.-N.). Sur la pathogénie et le traitement de l'anémie pernicieuse et infectieuse du cheval. [The Pathology and Treatment of Equine Pernicious and Infectious Anaemia.]—*Receuil de Méd. Vét.*, 1916. Jan. 15-Feb. 15. Vol. 92. Nos. 1 & 2. pp. 14-20.
- (170) TERNI (C.). Ricerche ed esperienze per lo Studio della immunità all'Afta. [Immunity against Foot and Mouth Disease.]—*Clinica Vet.*, 1916. May 15. Vol. 39. No. 9. pp. 257-261.

TROPICAL DISEASES BUREAU.

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[No. 3.

PROTOZOOLOGY.

(a) AMOEBIASIS.

- (171) DARLING (S. T.). Entamebic Dysentery in the Dog.—*Proc. Med. Assoc. Isthmian Canal Zone for the Half-Year, Apr. to Sept. 1913 [1915.] Vol. 6. Part 1.* pp. 60-62.

This appears to be the first case recorded of naturally acquired entamebic dysentery in the dog.

The subject was a large deerhound which had been in the Panama Canal Zone for several months and had just been brought into the laboratory for observation in connection with hookworms. On admission it was suffering from blood-stained diarrhoea and great abdominal pain. Faeces on examination were found sometimes to contain trophozoites. The animal became very emaciated and died after 11 days.

Post-mortem examination showed that the mucous membrane of the colon was dotted all over with innumerable minute red punctate superficial erosions, but no large ulcers. Smears always contained entamoebae in which at times red blood cells were seen. The ileum contained hundreds of hook-worms, but smears of the mucous membrane contained no entamoebae although a few were seen in sections on the surface.

On histological examination the minute red ulcers on the mucous membrane of the colon were seen to be infiltrated with leucocytes and entamoebae. The superficial portion of the ulcers was denuded of epithelium, and the surrounding surface was covered with mucus which contained many trophozoites apparently vegetating in it. Clumps of entamoebae could be seen in places making their way into the intestinal crypts. The invasion was very superficial and the submucosa and muscularis were not involved. The lesions were thus not like those seen in the cat experimentally infected per rectum with the trophozoites of *E. tetragena* of man. This suggests that the lesions were caused by a different species of entamoeba.

Description of the trophozoite.—In the wet state it measured from 16 to 32 microns in diameter; the majority contained no red blood corpuscles but some contained up to 8 or 10. The ectosarc was clear and well differentiated from the endoplasm which was granular and

contained vacuoles. The nucleus and usually its karyosome were easily detected. When stained *intra vitam* with gentian violet the peripheral chromatin of the nucleus was displayed as many fine particles, and the centriole and karyosome were distinctly shown. With phosphotungstic acid haematoxylin, and iron haematoxylin, the trophozoites stained well and the nucleus was seen to be made up of rather fine chromatin granules. The centriole was not uncommonly eccentrically placed while the karyosome appeared as a finely granular ring.

Specimens dry fixed and stained with Giemsa and differentiated with ammoniated ethyl alcohol present a picture not unlike *E. tetragena*, except that the karyosome is quite different from that usually seen in the latter. It is smaller and more dense, its band is broader and it is never seen in the form of a reticulum, nor as granules scattered through the nucleus as in *E. tetragena*. Specimens in films wet fixed and stained with haematoxylin gave the following average diametrical measurements in microns. Trophozoite 21 to 28, nucleus 5·5, karyosome 2·4, centriole 0·7.

All the trophozoites were of the large vegetative type usually seen in active lesions. Their appearance was in general like that of *E. tetragena* except for important differences in structure of the nucleus. Cysts and other perpetuating forms were not discoverable. A puppy fed with material containing trophozoites six hours after the death of the host did not contract the disease. Rectal inoculations were not made.

From the characters enumerated above the author believes that the entamoeba found in the dog differs from *E. tetragena* and *E. coli* which cause lesions in the cat and man, and provisionally proposes the name *E. venaticum* for this new species.

(172) WARE (F.). The Possibility of Amoebic Dysentery in the Dog, and its Treatment with Emetin.—*Jl. Comp. Path. & Therap.* 1916. June. Vol. 29. Pt. 2. pp. 126-130.

Fresh faeces were examined microscopically from a rather acute case of dysentery in a bitch. This animal belonged to a pack of foxhounds kept at a hill station in India, in which dysentery was stated to have been a considerable source of trouble for some years past. In these smears of faeces one or more amoebae, which were pronounced to be extremely like *Entamoeba histolytica*, the cause of amoebic dysentery in man, were present in at least every other field of the microscope. Six other animals were also clinically affected but not to so serious an extent as in the above case. No microscopic examination was made of their faeces.

All the above cases were treated with injections of emetin hydrochloride in daily doses of $\frac{1}{2}$ or 1 grain until the symptoms abated. All quickly recovered except one case, where the animal had been ill for ten months. Post-mortem examination of the latter animal indicated that the large intestine was affected with numerous small ulcers, the stomach was considerably inflamed, and the liver enlarged. No search for amoebae seems to have been made.

- (173) THOMSON (J. Gordon) & THOMSON (D.). Some Observations on the Effect of Emetine Administration on the Free Vegetative Forms and Cysts of *Entamoeba histolytica* and *Entamoeba coli*.—*Jl. Roy. Army Med. Corps.* 1916. June. Vol. 26. No. 6. pp. 683-694. With 1 plate.

Summary of Conclusions.

"(1) If an amoebic case receive a continuous course of treatment with emetine of not less than a total of seven to ten grains of the drug administered in grain doses daily for a week, it is probable that he will never become a carrier of cysts. In order, however, to make certain of this, it is better to carry the treatment further. Such treatment also prevents relapses."

"(2) Cysts of *E. histolytica* can be cleared out of a patient after six grains of emetine, but, to make absolutely certain of this, it is better to exceed this dose. This treatment must be combined with saline purgatives, so as to get free daily action of the bowels."

"(3) A case of amoebic dysentery inefficiently treated with less than seven grains of emetine is likely to become highly dangerous as a carrier of cysts. One or two small doses may act beneficially and get rid of active symptoms, such as the passage of blood and mucus, but it may at the same time stimulate the formation of large numbers of cysts. The cessation of treatment on the disappearance of active symptoms is fraught with danger, both to the patient, and subsequently, to others."

"(4) All patients known to have blood and mucus in their stools and to have received less than an efficient total quantity of emetine ought to be examined for the presence of cysts in the faeces, as it is highly probable they have thereby become dangerous carriers."

"(5) The transmission of amoebic dysentery is undoubtedly due to the ingestion of cysts. This is brought about by the contamination of food, fingers, or flies. Cysts may also be carried along with sand particles by wind."

"(6) The powers of resistance of cysts outside the body are considerable, and this should be borne in mind by all responsible for sanitary prophylactic measures against dysentery."

(b) ANAPLASMOSIS.

- (174) WALKER (J.). Some Observations in connection with the Immunisation of Cattle against South African Redwater and Genuine Gallsickness (Anaplasmosis).—*Union of South Africa. Dept. of Agric. 3rd and 4th Reports of the Director of Veterinary Research.* 1915. Nov. pp. 501-526. With 1 chart. Pretoria : Govt. Printing & Stationery Office.

The author begins this article by giving a complete review of the literature dealing with anaplasmosis.

(1) OBSERVATIONS IN CONNECTION WITH THE TRANSMISSION OF REDWATER.

A series of 24 inoculations and immunity tests with redwater-gallsickness blood was performed on cattle, the results of which are summarised as follows:—

"1. The inoculation of susceptible cattle with redwater-gallsickness blood did not always result in a reaction to redwater. (No rise of temperature occurred and no *P. bigeminum* were noted in the smears. Animal remained apparently healthy).

"2. The blood of an animal which gave no reaction to redwater when inoculated with redwater-gallsickness blood does not transmit redwater to susceptible cattle.

"3. Susceptible animals which failed to react to redwater after inoculation are susceptible to redwater.

"4. The inoculation of a susceptible animal with blood which was collected from a beast when reacting to redwater, and in which *P. bigeminum* parasites were frequent does not always produce a redwater reaction (one experiment), and the animal remains susceptible to redwater.

"5. An animal which has reacted to a strain of redwater may again react when inoculated with blood of a different strain.

"6. The redwater reaction may manifest itself in a rise of temperature without the appearance of *P. bigeminum* in the smears during or shortly after the temperature reaction."

(2) OBSERVATIONS IN CONNECTION WITH THE TRANSMISSION OF ANAPLASMOSIS.

(A) *The Invariability of Transmission of Anaplasmosis by means of inoculation of redwater-gallsickness blood.* From the above experiments the author also draws the following conclusions:—

"(1) That the inoculation of susceptible cattle with redwater-gallsickness blood did not always produce a reaction to redwater; a reaction to anaplasmosis however invariably occurred.

"(2) The blood of animals which failed to react to redwater after inoculation with redwater-gallsickness blood produced in susceptible cattle anaplasmosis but not redwater.

"(3) Blood collected from an animal which had been inoculated with redwater-gallsickness blood during the redwater reaction and thus before the anaplasma infection appeared did not produce anaplasmosis in a susceptible animal.

"(4) The shortest period in which *Anaplasma marginale* appeared after inoculation was 20 days, longest period 44 days, average period 31 days. For *A. centrale* the shortest period was 16 days, longest 47, average 32 days."

(B) *The Mutability of Anaplasma centrale.*

THEILER has classified the anaplasmata into two varieties, viz., the *Anap. marginale* and *Anap. marginale* (variety *centrale*); the former is responsible for deaths occurring from genuine gallsickness contracted naturally while the latter is much less virulent and, when inoculated into a susceptible animal, transmits the Centrale infection and protects against the former (the *Anap. marginale* proper). [Hence THEILER's method of immunisation against gallsickness.] It was found that inoculation of the blood of an animal immune to the Centrale variety did not always result in a pure Centrale infection being transmitted, but produced in some cases a pure Marginale infection. A series of experiments was performed, which are recorded on the charts, in order to see whether mutation from Centrale to Marginale occurs in "passage" through animals. The author's conclusions are given in the following résumé:—

"The observations extended over a period of five years and a few days, namely, from 28th February, 1910, to the 8th March, 1915; during this time forty-three cattle were inoculated, and in thirty-five of these the experiment was controlled by the writer.

"In the first series of inoculations no mutation occurred during the passage through eight successive generations, viz. from the 28th February, 1910, to 30th December, 1913.

"An animal inoculated approximately eight months later than the latter date with blood of the seventh generation and two animals inoculated with blood of the eighth generation reacted to *Anaplasma marginale*.

"In the second series of inoculations, whereas no mutation occurred in some cases in passage through successive generations, viz. from the 28th February, 1910, to the 8th March, 1915, two cattle inoculated with blood of an eighth generation animal reacted to *Anaplasma marginale*.

"In the third series of inoculations, whereas centrale blood of the sixth generation produced a centrale infection, blood obtained from the same animal, approximately five and nine months later, produced a marginale infection and the inoculation of the blood of two imported animals which reacted to *Anap. centrale* resulted in a marginale infection."

"Conclusion."

"A mutation from *Anap. centrale* to *Anap. marginale* may occur in passage through a susceptible animal."

"The determination of the type is probably according to the Mendelian law, the marginale being the dominant—the centrale the recessive type."

(175) VEGLIA (F.). The Cultivation of *Anaplasma marginale* in Vitro.—*Union of South Africa. Dept. of Agric. 3rd & 4th Reports of the Director of Veterinary Research. 1915. Nov. pp. 527-532. Pretoria: Govt. Printing & Stationery Office.*

"The culture media utilised were:—

"(1) Pure defibrinated blood, viz., blood from an animal infected with anaplasmosis.

"(2) Salt solution (sodium chloride) as used by Nuttall for the cultivation of *Babesia canis*.

"(3) Sodium citrate solution, as used by Carpano for the cultivation of *Nuttalla equi*.

"(4) Ordinary bouillon, as used by Miyajima for the cultivation of *Babesia bovis*". . . .

"Conclusions:—

"(1) Anaplasms grow and multiply in the different artificial media indicated above.

"(2) Defibrinated blood and Carpano media are most suitable for the cultivation of anaplasms.

"(3) Basophile granulations and Jolly's bodies, which are noted in anaemic blood, behaved differently to anaplasms on cultivation, inasmuch as they did not increase in number and finally disappeared.

"(4) Normal blood of cattle and other animals not infected with anaplasms did not develop any intracellular bodies resembling anaplasms when cultivated in the way indicated.

"(5) In cultures made with pure anaplasms or anaplasms and babesia mixed, no forms could be traced which would suggest a transition of one to another.

"(6) The defibrinated blood of a susceptible normal animal mixed with a culture appeared to be favourable for the development of the anaplasms, whilst the blood of an animal recovered from the recent attack of anaplasmosis appeared to inhibit the growth of the anaplasma.

"(7) The cultivation of anaplasms by a sub-culture has so far succeeded in the one instance attempted.

"(8) It appears that it is possible to grow anaplasms taken from an infected animal during the incubation stage of the disease.

"(9) The increase of anaplasms in the cultures corresponds to the increase of the anaplasms in the living animal.

"The oscillating decrease in the number of anaplasms noted in an animal that is recovering has its simile in the cultures."

(c) LEISHMANIASIS.

(176) FINZI (Guido). Leishmaniose et tuberculose chez le chien.
[Leishmaniasis and Tuberculosis in the Dog.]—*Bull. Soc. Path. Exot.* 1916. July. Vol. 9. No. 7. pp. 429-432.

Finzi records the case of a dog which had been brought for treatment to the clinic of the Veterinary School at Turin, and which later died of generalised tuberculosis. On examining preparations from the blood and spleen *Leishmania infantum* was easily discoverable. This dog had been brought from Cyrenaica a month prior to its death.

(d) AVIAN MALARIA.

- (177) GONDER (R.). On the Transmission of *Haemoproteus columbae*.—*Union of South Africa. Dept. of Agric. 3rd & 4th Reports of the Director of Veterinary Research.* 1915. Nov. pp. 625-632. Pretoria : Govt. Printing & Stationery Office.

Gonder expressed his views upon the natural transmission of *H. columbae* at the International Medical Congress in London in 1913, and the investigations upon which these views were based are published in this article. The following is the author's summary :—

"The infectivity of the parasite *Haemoproteus columbae* is not hereditary in the fly-carrier. The parasite develops in the fly, *Lynchia capensis* (*olfersia*), only to the ookinete, which, through a double protoplasmic segmentation, loses all its pigment and a part of its protoplasm. So long as the ookinete are present in the stomach of the fly transmission of the parasite by the fly is possible."

"The flies 'clean' themselves from an infection whenever they engorge on the blood of a healthy pigeon, but do not become immune against reinfection."

"A cleansing of the flies cannot take place so long as they feed upon infected pigeons."

"Artificial transmission from infected pigeons to healthy pigeons cannot be brought about by ordinary blood inoculation, but is easily effected by the injection of ookinete cultivated in the moist chamber."

"Direct transmission is also possible if lung material be used."

(e) SARCOSPORIDIOSIS.

- (178) GALLI-VALERIO (B.). Are Sarcosporidia Aberrant Forms of Cnidosporidia of Invertebrates?—*Jl. Parasit.* 1916. Mar. Vol. 2. No. 3. pp. 126-128.

DARLING (1915) suggests that, on account of the facility with which herbivora can ingest the bodies or the excreta of insects, etc., infected with neosporidia, it is possible that sarcosporidia may be "side-tracked varieties" of some of these parasites of invertebrates which are unable to continue further their life cycle in the muscles of an indefinite host.

SCOTT (1915) also infers from his experiments that the sheep is not the definite host of *S. tenella*.

The author states that it is probable that sarcosporidia are identical with cnidosporidia, and believes that if it is possible to demonstrate that spores of sarcosporidia produce amoebae the identity of the two orders is still more probable.

PIANA (1896) obtained from cultures of *S. tenella* on certain media, bodies which presented motile amoeboid movements and later became encysted. The author himself (1913) confirmed these experiments with *S. muris*. It was not possible to produce Balbiana cysts in the oesophagus of a sheep infected with Piana's cultures.

ERDMANN (1914) observed amoeboid bodies in the intestinal cells of a mouse infected *per os* with sarcosporidia.

Reference is also made to the similarity between the amoebae of certain myxosporidia and those of *S. muris*.

THÉLOHAN and AUERBACH proved that the spores of cnidosporidia produced amoeboid bodies in the duodenum of fishes.

The author believes that the amoebae obtained from cultures of sarcosporidia may be destroyed in the stomach and suggests that in future experiments they might be introduced direct into the intestines of sheep.

The author's summary is as follows :—

"(1) The observations of Piana and Galli-Valerio to the effect that spores of Sarcosporidia produce amoebic bodies in cultures, more closely relate the Sarcosporidia to the Cnidosporidia.

"(2) If true that Sarcosporidia are only aberrant forms of Neosporidia of invertebrates, then the hypothesis of Darling becomes more probable."

- (179) FRANCO (E. E.) & BORGES (I.). *Sur la sarcosporidiose bovine.* [Bovine Sarcosporidiosis.]—*Arg. do Inst. Bact. Camara Pestana.* 1916. Vol. 4. No. 3. pp. 269-289. With 10 coloured plates comprising 19 figs., & 1 plate comprising 4 figs.

In the course of the years 1885 to 1914, 67 carcases of cattle were rejected at the Lisbon Municipal Abattoir on account of sarcosporidiosis, representing 0·0563 per cent. of animals slaughtered. The animals affected were in the great majority of cases brought in from the Alentejo province.

The lesions affected the connective tissue, subcutaneous and intermuscular, and took the form of small cysts from 250 to 400 microns in diameter which resembled fine grains of sand in appearance. They were sometimes gathered together in groups, and sometimes disseminated at distances less than 5 millimetres apart. Lesions of "anasarca and elephantiasis," such as described by BESNOIT and ROBIN, were not seen by the authors.

The article is almost entirely devoted to an analysis of the histology of the lesions ; the life history of the parasite is not studied.

Cysts.—These are composed of three parts, which are derived from the parasite itself, viz. :—(A) an external "anhist" membrane, (B) a cellular internal membrane consisting of a finely reticulated protoplasmic layer, and (C) the spore contents consisting of an enormous number of very small, closely packed, crescentic bodies.

Around the cysts is seen a zone of reaction of variable thickness consisting of (a) connective tissue cells, (b) eosinophile leucocytes, and (c) plasma cells.

In one of the cases histologically examined an account of cysts invading the dermis and the muscles is given.

A large number of the cysts were found to have become ruptured and, instead of spores, contain various connective tissue cellular elements.

The histology of the lesions is well depicted in the coloured plates.

The authors believe that the sarcosporidiosis observed by them is the same as that studied and described by BESNOIT and ROBIN, due to the genus *Sarcocystis besnoiti* (MAROTEL, 1912).

(f) SPIRILLOSIS.

- (180) BLIER (Jules). *L'hémoglobinurie bovine du Chili (Maladie à parasites spirochétiformes).* [Bovine Haemoglobinuria in Chili (a Disease Due to Spirochaetoid Parasites).]—*C. R. Acad. Sci.* 1914. Dec. 14. p. 815. [Extracted in *Rev. Gén. de Méd. Vét.* 1916. June 15. Vol. 25. No. 294. pp. 262-264.]

There exists in Chili, in the district of Santiago, a redwater of cattle commonly known as *Meada de Sangre*. It is a rather rare seasonal affection most frequent in autumn (i.e., February and March).

The characteristic symptoms are a discharge of blood-tinged urine accompanied by fever, exophthalmia, mania, vertigo, general icterus, and a discharge of blood from the anus, and the gums often bleed.

The disease generally runs its course in about 48 hours and always ends by the death of the animal. In farms where imported cattle are numerous, up to 5 per cent. of the bovines may succumb annually to the disease. However, throughout Chili it is a good deal less common than anthrax, with which it is often mistaken, and this confusion is aggravated by the presence of blackquarter. It had previously been noticed that the anthrax bacillus was absent from the spleen in these cases.

If the animal is slaughtered at the onset of symptoms the lesions show a considerable resemblance to those of yellow fever, viz., yellowish discolouration of the flesh and serous membranes, blood in the stomachs, hypertrophy of the gall bladder, haemoglobinuria, and liver affected with fatty degeneration and spotted with small haemorrhagic centres about the size of peas in which the parasite which is the cause of the disease can be found. Also, one notices hypertrophy of the spleen, profound changes in the suprarenal capsules, subcutaneous haemorrhages, often on the diaphragm a veritable roseola, and sometimes a blood-stained subcutaneous oedema. These lesions disappear if the disease is allowed to terminate with the death of the animal.

The clue to the cause of the disease is given by early slaughter. The specific germ was not perceived for a long time for, as in Sakharoff's spirillosis of geese, bacteriolysis takes place before death. In spite of the redwater the disease is not a piroplasmosis, and various observers have confirmed this point (LUCET, LIGNIERES, SIVORI, MAMERTO CADIZ, MABILAIS, BLIER). Ixodes have never been found on affected farms.

The redwater is caused by an organism which the author considers he discovered in 1912, and which he has always been able to discover since then on slaughter at the onset of symptoms. The organism apparently is not easy to classify. It recalls at first sight a spirillum or spirochaete, but it differs from them in that it possesses a plasticity which enables it to execute contractile movements. It is longer as a rule than the majority of known spirochaetes, and it may exceed 60 microns in length and its breadth then is about 1 micron. The shorter forms are swollen towards the centre. It is sometimes provided with a few undulations of regular length but these are never found in the same part of the body. One extremity of the organism is much thinner than the other. It stains uniformly with Giemsa. When stained with Borrel's blue and eosin it sometimes shows bright red, refractile granules. Ordinarily the organism has the form of a spirochaete, but it recalls the parasite described by the brothers SERGENT (genus *Sergentella* of BRUMPT, 1910) and other observers.

The author considers that it is the causal organism of the disease because when taken from the small haemorrhagic lesions in the liver of a subject slaughtered at the commencement of symptoms, desensitised by washing for 15 minutes in lukewarm sterile broth, and inoculated into the abdominal cavity of cattle it reproduces the disease, but with mild symptoms (slight fever, hepatic roseola, biliary haemoglobinuria, and the presence of the parasite in the lesions).

The period of incubation is from five to six days and during this period one can recover the microorganism from the blood by means of centrifugalisation. As in the case of yellow fever the disease can only be transmitted at the onset of symptoms. The desensitisation of the virus appears indispensable and all other methods of inoculation have failed in the author's hands.

The specific organism was not found in numerous post-mortem examinations of animals not affected with the disease, and in the affected animals it can only be found in the lesions, where it sometimes requires considerable search. It has never yet been seen alive.

As in the case of yellow fever recoveries occur; relapses may take place, but never in the same season, and they are exceptional. It is probable that they are due to re-infection. As they take place at intervals of several years a certain degree of immunity is probable. Young animals are never infected. A single case of transmission to the foetus has been observed by the author.

The sporadic nature of the redwater strongly points to infection by indirect contagion. The transmitting agent is unknown but many breeders incriminate an acarus of the genus *Tetramychus* which lives in the grass and weaves webs and is ingested by cattle whilst grazing. This opinion is very much disputed, but the disease is sometimes known under the name of *tela araña* (spiders web). Some farmers get rid of this web by harrowing the pastures. The heavy autumnal rains cause the enzootic very nearly to disappear.

It seems that one or more substances of unknown nature considerably delay putrefaction in animals dead of the disease.

- (181) VELU. Sur la spirillose equine au Maroc. [Equine Spirillosis in Morocco.]—*Rec. Méd. Vét.* 1916. Apr. 15. Vol. 92. No. 7. pp. 215-224. With 2 text-figs.

Equine spirillosis has been described by THEILER in the Transvaal, by G. MARTIN in French Guinea, S. DODD in the Transvaal, STORDY in British East Africa, and CARPANO (Matteo) in Erythrea.

The specificity of *Spirillum equi* has not yet been established. Experimental inoculations seem to have been difficult to realise. The spirillary infection is without doubt often associated with other affections such as trypanosomiasis or horse sickness. Also the differences between the pathogenicity of the various equine spirilla encountered are very considerable.

Velu has studied the disease in three horses naturally infected, which were kept under his observation. Clinically the disease presented the same aspect as that of trypanosomiasis affecting horses in Morocco, viz., a mild fever accompanied with oedema of the sheath, etc., from which the animals apparently recovered after a couple of months. Examination of the blood during the course of the symptoms only on very few occasions showed some rare spirilla.

Velu succeeded in transmitting the disease by inoculation to white rats, dogs, a rabbit and two fowls, and he thus summarises his results : "Spirillosis of the horse is transmissible to the dog, rabbit, and rat. Animals which receive subcutaneously or intravenously from 3 to 20 cc. of horse blood which does not disclose any visible spirilla under the

microscope, become affected with a disease which terminates fatally and is characterised by low fever, progressive emaciation, and numerous parasites in the peripheral blood. The spirilla disappear pretty quickly from the general circulation. It is possible to transmit this spirillosis by 'passage' from the dog to the rabbit and the rat."

The spirilla measured from 12 to 21·6 microns in length when not uncoiled, by from 0·25 to 0·3 microns at most in width, and contain from four to six spiral turns. Forms about to undergo transverse division may attain a maximum length of 33·6 microns and present up to 10, or even 12, spiral turns. The spirillum stains uniformly throughout its body.

(182) ROBERT (A. Eug.) & SAUTON (B.). Action du bismuth sur la spirillose des poules. [The Action of Bismuth on the Spirillosis of Fowls.]—*Ann. Inst. Pasteur.* 1916. June. Vol. 30. No. 6. pp. 261-271.

The authors utilised for their experiments sodium bismuthotartrate, as aqueous solutions of this compound can be sterilised in the autoclave and they are stable in the presence of the majority of salts, serum, etc., but are, however, precipitated by calcium salts. In all their experiments they used solutions containing exactly one per cent. of bismuth itself, not of the bismuthotartrate.

Toxicity. A dose of from 30 to 35 mg. of Bismuth per kilog. body weight injected intravenously can be tolerated by a healthy fowl; animals infected with spirilla can only stand a dose of 15 to 20 mg.; 100 mg. of bismuth per kilog. injected intramuscularly can be tolerated without any inconvenience by healthy fowls.

Action in vitro. When equal parts of blood from a fowl severely infected with spirilla and a neutral solution of sodium bismuthotartrate containing 1 per cent. of bismuth are mixed, *Spirillum gallinarum* retains its motility for more than three days.

Action in vivo. The authors used as virus undiluted blood rich in spirilla.

Preventive Treatment. The intravenous injection of 20 to 30 mg. of bismuth per kilog. 24 hours before inoculation with 0·5 cc. of infective blood delays the appearance of spirilla by a day and then the disease develops normally, probably due to a too rapid elimination of the salt or to its having become partially insoluble in the body. On the other hand in the same conditions of time an intramuscular injection of 50 to 70 mg. of bismuth per kilog. acts efficaciously.

The injection of bismuth a few hours after infection always retards the development of the organisms. At no period can spirilla be found in the blood of a fowl injected intravenously six hours after infection with a dose which, however, is not well tolerated—of 20 mg. of bismuth per kilog. In the same conditions an injection of 15 mg. does not always prevent the disease to the same degree. The disease when it manifests itself is, however, benign and always disappears after a second injection. Treatment with 10 mg. brings about only a slight delay in the appearance of spirilla and the disease then develops as in control animals.

Better results were obtained by giving two successive injections of bismuthotartrate, 6 hours and 30 hours respectively, after inoculation with spirilla. The organisms never appeared in the blood of animals treated with two doses of 15 mg. each. Positive results were also obtained in four cases out of every five by two injections of 10 mg. each, or by successive injections of 10 and 5 mg., respectively. It is noteworthy that these two last doses are more efficacious than a single equivalent dose of 15 mg. because the circulation of bismuth in the body is renewed.

An intramuscular injection of 60 to 70 mg. of bismuth per kilog. four hours after infection delays and considerably alleviates the disease. Spirilla only appear in the blood of animals thus treated in very small numbers and during a very short period of time.

Curative Treatment. When, after the first appearance of the spirilla, one treats an infected animal by giving an intravenous injection of 12 to 15 mg. of bismuth per kilog. the spirilllosis takes on a milder course, and fowls thus treated generally show organisms no longer in their blood when the infection is at its maximum in the case of control animals. If intervention takes place later, 48 to 72 hours after infection, a distinctly curative action of the bismuth is observed and the disease never takes on an acute form, which in the authors' experiments caused the death of 33 per cent. of animals which were not treated.

However, the best results are obtained by treating infected animals with two successive intravenous injections of 10 mg. per kilog., 30 and 48 hours, respectively, after inoculation with spirilla. The organisms then never, or hardly ever, develop in the blood after the first injection ; they have always disappeared 24 hours after the second. The treated animals remain in good condition and do not as in the case of control animals lose a considerable amount of weight.

CONCLUSIONS. "From these experiments it results that sodium bismuthotartrate, contrary to what one observes *in vitro*, exerts a bactericidal action on *Spirochaeta gallinarum* in the animal body. Its influence, which was very distinct since we were able to prevent and cure the infection in a relatively large number of cases, was not, however, always manifested in our experiments with all the regularity desirable. This depends probably on the nature of the bismuthic combination utilised, which, from our observations, may lose its activity as a result of fixation or insolubilisation. It is presumable, and our experiments, abruptly interrupted at the end of July 1914 by the war, already confirmed this hypothesis, that the best results would be obtained by the use of bismuthic compounds susceptible of circulating better in a soluble form in the body. We hope to continue some day our incomplete researches in that direction, but we can already say that we have observed the constant efficacy of bismuth, whatever may be the nature of the chemical combination it forms part of."

(g) TOXOPLASMOSIS.

- (183) CARINI (A.) & MIGLIANO (L.). *Sur un Toxoplasme du cobaye (Toxoplasma Caviae, n. sp.). [A Toxoplasm of the Guinea-pig].* —*Bull. Soc. Path. Exot.* 1916. July. Vol. 9. No. 7. pp. 435-436.

In a young guinea-pig found dead without having shown previous symptoms the authors discovered the presence of toxoplasms.

On post-mortem examination the spleen was three or four times the normal size, friable, and soft in consistence ; the liver was increased

in size and congested, the lungs showed some congested centres, and the intestines also were reddened.

Microscopic examination of the affected organs showed, after staining with Leishman or Giemsa, bodies which presented all the characters of toxoplasms. They were 5 to 8 microns long by 2 to 4 microns broad, generally a little curved, oval or pear-shaped, rarely rounded or irregular. The protoplasm stained a pale blue colour and the nucleus a reddish-violet. The parasites were generally free, but sometimes endocellular. In preparations from the liver, organisms undergoing multiplication were found in the form of masses of protoplasm in which were scattered numerous nuclei.

Two pigeons were inoculated subcutaneously with an emulsion of the affected organs. They both died in 17 days. For the first 14 days no visible symptoms were observed; during the last three days there were manifested an intense thirst, inappetence, and during the last day the pigeons became very dejected and their feathers stood erect.

On post-mortem examination the following lesions were noted, viz., on the surface of the lungs numerous small greyish spots which corresponded with centres of necrosis, and the liver was very much enlarged and congested. The parasites were very numerous in the liver, and still more numerous in the lungs.

The authors state that they had previously observed the presence of toxoplasms in guinea-pigs, but these had been inoculated with various pathological products, and so they were not certain that they were dealing with spontaneous infections. Several observers have already noted that guinea-pigs can be experimentally infected with toxoplasms.

The authors believe that the case recorded by them enables them to state definitely that one may encounter spontaneous infections with toxoplasms in the guinea-pig. It is probable that the toxoplasm seen in the guinea-pig is the same as that of the rabbit and the dog, but this has not yet been proved, and the name *Toxoplasma caviae* is thus suggested.

The following list of toxoplasms recorded up to the present is given :-

<i>Toxoplasma cuniculi</i>	..	SPLENDORE, 1908.
„ <i>gondii</i>	..	NICOLLE and MANCEAUX, 1908.
„ <i>canis</i> ..	..	MELLO, 1910.
„ <i>talpae</i>	..	MINE, 1910.
„ <i>columbae</i>	..	CARINI, 1911.
„ <i>musculi</i>	..	SANGIORGI, 1913.
„ <i>avium</i>	..	ADIE 1909; MARULLAZ, 1913.
„ <i>pyrogenes</i>	..	CASTELLANI, 1914.
„ <i>ratti</i> ..	..	SANGIORGI, 1914.
„ <i>caviae</i>	..	CARINI and MIGLIANO, 1916.

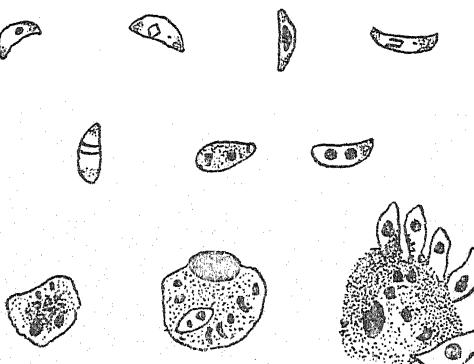
(184) van SACEGHEM (R.). *Observations sur des infections naturelles par Toxoplasma cuniculi.* [Observations on Natural Infections by *Toxoplasma cuniculi.*]—*Bull. Soc. Path. Exot.* 1916. July. Vol. 9. No. 7. pp. 432-434. With 10 text-figs.

Natural cases of the above disease were found by the author in rabbits born in the Lower Congo; the disease was only observed in the case of young subjects from $2\frac{1}{2}$ to 3 months old.

The rabbits which became affected were kept in a large box supported by four poles about 27 cm. high. Rabbits in cages placed at the height of 1 metre remained all unaffected. The author believes that this fact suggests that, if an insect is the transmitting agent of *Tox. cuniculi*, then this insect can only move about at relatively low heights and that it is probably wingless.

The symptoms are those of a profuse anaemia and inappetence, followed later by paralysis just before death. On post-mortem examination one finds a yellowish exudate in the peritoneal cavity, very considerable enlargement of the spleen, which is covered with whitish spots and ecchymosed, and the liver as well as the lungs are covered with similar spots, which, at first sight closely resemble miliary tubercles. The blood shows basophilia and lymphocytosis, but no parasite was found in the peripheral circulation.

Smears from the spleen stained with Giemsa showed up quite easily the typical parasite of SPLENDORE. Beside the characteristic crescentic forms the author discovered more or less spherical organisms. The average length of the parasite was from 6 to 7 microns although certain forms undergoing division attained 21 microns in length. The position of the nucleus is very irregular; it may be central, terminal, or in some intermediate position. One or two chromatin granules were sometimes found within it.



The parasite is found in the large mononuclear cells of the spleen, and in some of these cells it may be seen undergoing a process of division by schizogony. At a certain stage the large mononuclear cell, whose nucleus has been pushed towards the circumference, becomes broken up, and young merozoites are set free (see the two figs.* on right of lower line). Forms up to 21 microns in diameter were seen, more or less circular in outline, and containing a large number of nuclei. The author could not find the remains of the nucleus of the large mononuclear cell in them and so inferred that these large forms of the protozoon are in reality schizonts. The protoplasm of the parasite is very irregularly stained by Giemsa; in some cases it stains an intense blue, in other cases it does not stain at all.

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PARASITOLOGY.

(a) HELMINTHIASIS.

(185) DESCAZEUX (M. J.). Contribution à l'étude de l' "esponja" ou plaies d'été des Equidés du Brésil. ["Esponja" or "Summer Sores" of Equines in Brazil. (RAILLIET'S Report of a Commission to the Soc. Cent. de Méd. Vét. 17 June 1915).]—*Rec. de Méd. Vét.* 1915. Jan. 30 to Sept. 30. Vol. 91. Nos. 19-20. pp. 468-486. With 3 text-figs.

In this report Railliet analyses the whole question of "summer sores" of equines, basing his conclusions chiefly on information collected by Descazeaux, who has studied the disease in Brazil.

A very clear and concise description is first given of the clinical characters and morbid anatomy of the disease, particularly as it occurs in Brazil. The granular dermatitis is stated to present numerous variations in its characters according to the countries in which it is observed, as for example in India, Africa, Oceania, and in tropical America.

The report is mainly of importance in that it throws new light on the etiology of summer sores. It is well known that in numerous observations the presence of a nematode has been determined in the granulations of "summer sores," but our clinical knowledge is not yet so precise that one can differentiate, by means of a simple external examination, between verminous dermatitis and dermatites attributable to other elements than worms. It is thus that in India one still often confuses, under the name of *bursati* or *bursathee*, cutaneous lesions caused by moulds and by nematodes.

ERCOLANI was the first to discover, in 1859, a larval nematode in the loose fibrous tissue at the base of the newly formed "umbilicate scabs" and he remarked that this larva bore a good deal of resemblance to the embryos of *Spiroptera megastoma* (now called *Habronema megastoma*). More detailed descriptions have lately been given of this parasite by BUFFARD, RIVOLTA, and FAYET and MOREAU.

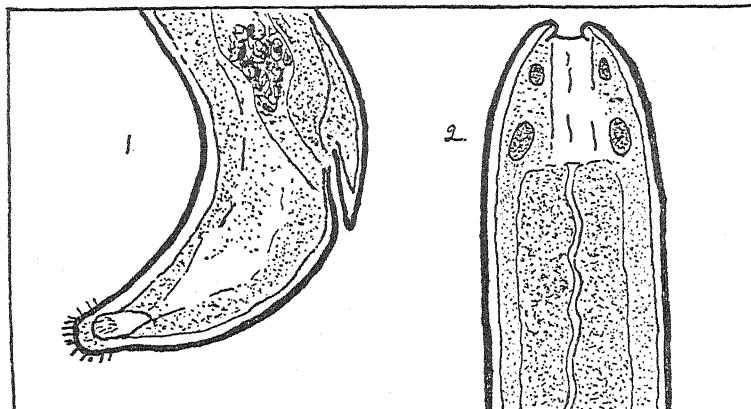
Descazeaux obtained the nematodes from granulations about 15 to 20 days after their first appearance. A piece of non-calcified granulating tissue was thus placed on a slide with a drop of 0·2 per cent. hydrochloric acid. After about five minutes the tissue is broken up by means of coarse dissection with a pair of fine needles. One looks under the microscope in the dissociated pieces for the presence of the nematode and a head or a tail is found pretty easily. One then retains only the small piece of tissue containing the parasite, keeping a watch on its dissolution and helping it by means of cautious dilaceration, for the worm is easily broken. As soon as the latter is isolated the slide is dried and the specimen covered with a cover glass. A drop or two of lactophenol is introduced between the slide and cover glass, and the latter is then bordered with paraffin wax.

Descazeaux describes two kinds of parasite, viz. :—

(A) *Constant parasite*.—"Asexual" nematode, 2 mm. long by 45 to 50 microns broad. Cylindrical, filiform, slightly flattened body, thinner at its anterior extremity and terminating posteriorly in a blunt end covered with bristles; elongated intestine; flexuous uterus which "seems" to contain spherical eggs from 5 to 6 microns in diameter.

(B) *Inconstant parasite*.—This was discovered in one sore only out of more than ten examined, and was described as an "asexual worm" 900 to 950 microns long by 25 microns broad; elongated, cylindrical body, slightly thinner in front and terminating in a sharp drawn-out point. Said to contain a bifurcated uterus full of elongated eggs.

Railliet maintains that Descazeaux has here committed the same mistake as other authors, such as FAYET and MOREAU, in that he mistook the cells of the intestinal wall for eggs. One knows of no nematode possessing eggs of from 5 to 6 microns in diameter, so that the alleged uteri which he describes are, in reality, nonexistent.



Larva A.—1, posterior extremity showing end covered with tuft of bristles, and above and to the right, the anus; 2, anterior extremity showing mouth, vestibule or pharynx, and oesophagus with tortuous lumen.*

Railliet considers that the presence of the tuft of bristles at the extremity of the tail in the larval form (A), corresponding with what RIVOLTA had also previously described at the caudal extremity of his parasite, is of fundamental importance in that it enables one to determine approximately the classification of the nematode of "summer sores." Larvae with bristly tails have already been observed in a large number of animals—insects, etc.—and have been lately given a new name—*Agamospirura*—by HENRY and SISOFF to indicate their origin. They represent in reality the larvae of nematodes commonly designated under the name of *Spiroptera* (suborder *Spirurata* or super-family *Spiruroidea*).

In searching for the adult form of the larva of "summer sores," one can thus limit the field to the only genus of spiruroidea of which we know representatives in the horse, viz., the genus *Habronema* (Dies). The three species of spiroptera parasitic in equines belong to this genus, viz., *Habronema megastoma* (Rud.), *H. microstoma* (Schneid.), and *H. muscae* (Carter).

The evolution of the last named of these species has been described by RANSOM, and in his report Railliet summarises this evolution. As far back as 1861 CARTER, had found a larval nematode in the proboscis, head, and abdomen of the domestic fly. RANSOM showed that this larva

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belonged to a spiroptera, *H. muscae*, which lives in the stomach of the horse; the embryos evacuated with the faeces penetrate into the larvae of flies (living on horse manure), undergo development in these larvae, as well as in the pupae and fully formed insects, and finally reach the adult state in the stomach of the horse, when the flies are ingested by this animal. Besides the initial embryo and free-living form, RANSOM was able to distinguish six stages in the development of the larva within the body of the fly.

These stages, separated from one another by a moult, took place, the first two in the pupae or larvae, and the others in the winged fly. The nematode larvae increase in size from 400 to 450 microns in the first stage up to 2 mm. in length in the sixth or last stage. The bristles appear at the end of the tail in the fifth stage. The last stage of evolution in the fly is the first in the horse's stomach, where RANSOM collected it from among other forms more advanced in development and even adults. After about four or five moults in the stomach the worm reaches its adult state; the tail bristles are present after the first stage in the stomach but disappear afterwards.

The method of infection in the horse has not been accurately determined, but perhaps the larva escapes from the fly's proboscis while it feeds on the moist lips of the animal, or perhaps the horse also is infected by swallowing living or dead flies. The various forms of nematode described by different observers would correspond with the embryos or one or other of the larval stages of *Habronema*.

As regards the method of penetration of these larvae through the horse's skin, one is as yet limited to hypotheses. RIVOLTA believed that the penetration was from without inwards, and that it was favoured by the dirty condition of the animals and of stables. Descazeaux shares this view because he noticed that the "esponjas" are confined for the most part to the lower part of the limbs, and that certain ordinary wounds may at the end of a certain time become transformed into "esponjas." On the other hand LAULANIÉ noticed the arterioles of the dermis in course of obliteration and thus thought that the parasite was conveyed in the circulating blood. Also, LINGARD in India, whilst studying "*Bursati*" which he attributed to embryos circulating in the blood, pointed out that the presence of the characteristic granulations of these lesions was observed before the formation of an ulcer. One knows, however, that the larvae of Ankylostoma and Strongyloidae are able to penetrate through the skin of mammals without leaving any apparent traces of their passage.

Railliet is inclined to think that the nematodes penetrate from without inwards in the following manner. The *Habronema* embryos are thrown into the outside world with the excreta of the horse; they then penetrate through the skin of the animal in the same way as the larvae of ankylostoma, there setting up an irritation which may lead, by rubbing or scraping, etc., to the formation of a sore which takes on from presence of these larvae its particular characteristics. They develop as erratic parasites in this abnormal medium and undergo in it an evolution analogous to that which they normally accomplish in the body of the fly.

Treatment. Up to the present the *Spiroptera* have been looked upon as almost inoffensive parasites of the horse's stomach and no attempts are usually made to get rid of them. One knows now,

however, that the nematode of "summer sores" belongs to the cycle of evolution of one or several kinds of these parasites. Thus *a priori* the solution of the problem lies in the expulsion of these parasites from the horse's stomach, and one might try experiments in the use of tartar emetic or arsenious acid for this purpose.

Various medicaments employed locally have been of little or no use in the treatment of the disease, except that Descazeaux states that he obtained good results by rubbing the sores with 2 to 3 per cent. solutions of trypanblue. The only effective treatment is, however, the early and complete excision of the infected tissues.

- (184) MIGONE (L. E.). Parasitologie de certains animaux du Paraguay.
[Parasitology of Certain Animals of Paraguay.]—*Bull. Soc. Path. Exot.* 1916. June. Vol. 9. No. 6. pp. 359-364.

The chief parasites are *Haemogregarinae*, *Trypanosoma*, *Microfilaria*, *Myxosporidia*, and a parasite not well understood at present, *Linguatula*.

The author gives a list of birds, fishes, reptiles, and mammals with short descriptions of the parasites found in the blood and tissues of each. From his observations he deduces that there exist, in South America, parasites identical with those already known in the old world and in the other countries of America.

Linguatulæ. When one finds a fish affected, one observes at first sight in the abdominal cavity numerous linguatulæ and cysts of small linguatulæ. The peritoneum, mesentery, and parietal peritoneum are all affected with these parasites. This arthropod penetrates through the intestinal canal, its head always being directed towards the peritoneal cavity. Alongside the well-developed parasites from 1 to 3 centimetres long there are numerous cysts 1 to 3 mm. in diameter containing a little liquid and a small worm completely formed with its pseudo-articulations and hooks. The author believes that the parasite is *Linguatula serrata*. The parasite is also encountered in mammals which feed on the dead fish commonly found on the borders of streams and dried up lakes.

(b) ACARIASIS.

- (185) SHILSTON (A. W.). Sheep Scab. Observations on the Life-History of *Psoroptes communis* Var. *ovis*, and some Points connected with the Epizootiology of the Disease in South Africa.—*Union of South Africa. Dept. of Agric. 3rd & 4th Reports of the Director of Veterinary Research.* 1915. Nov. pp. 69-98. Pretoria: Govt. Printing & Stationery Office.

Practically the whole of our knowledge of the life-history of the acarus of sheep scab has been derived from investigators who recorded their observations over 50 years ago, notably GERLACH (1857). The observations of STOCKMAN were published while the experiments recorded by the author were in progress.

Very little attempt has been made to find out whether the life cycle of the sheep scab acarus differs in countries with widely different climatic conditions. Hence, a series of extremely interesting experiments were carried out by Shilston in which the complete life cycle of the parasite in South Africa was worked out.

In order to watch the development of the psoropt in its various phases on sheep the following technique is employed. The small patch of skin on which the parasites are to be deposited is carefully washed and shaved, and a glass cylinder three inches high by two inches in diameter is placed on it and secured around its base by means of melted wax. Its open end is tied over with a piece of muslin to prevent escape of the parasites; the adjoining locks of wool are then securely tied over the cylinder to prevent slipping. The parasites were moved on to a fresh spot every three or four days.

Life History on Sheep.—The weather has very little effect on the duration of the life cycle. It never occupies more than 10 days and in the great majority of cases it is complete in 9 days. The eggs usually hatch out after an interval of two days. The larval stage is short, nymphæ usually appear 48 hours after hatching of the eggs and always within three days. The nymphal stage lasts from three to four days. Pubescent females always appear before males. The former were observed $5\frac{1}{2}$ days after the hatching of the eggs but the latter were never seen earlier than the sixth day. The females are three or sometimes four times as numerous as the males. After feeding for a short time copulation takes place which lasts for about 24 hours. After moulting the ovigerous female is then formed, and it may commence to lay eggs 24 hours after this last moulting, that is, nine days from the time of hatching of the larva from the egg.

It is rather difficult to find out the number of eggs which can be laid by a female. In a number of observations it was found that a single female is capable of laying up to 100 eggs, but that the number laid depends largely on weather conditions. Laying usually commences on the 9th day and may continue up to the 38th day. The life of the ovigerous female on the sheep is from 30 to 40 days.

The longest period over which an unfertilised female was kept alive on a sheep was seven weeks, though the majority of such parasites died three or four weeks after moulting from nymphæ. Male acari lived for periods varying from 22 to 34 days after moulting from nymphæ.

Factors in the Epizootiology of Sheep Scab bearing on the Question of Eradication.—A single dipping is known to fail to cure scab owing to the escape of the eggs. The life-cycle being complete in nine days, dipping should thus be repeated in 10 days at the most. An extra day may be allowed because the fleece usually remains wet for a day after the first dipping. Owing to the protection of crusts, even adult parasites may be allowed to survive two immersions, hence a third dipping ten or fourteen days after the second would greatly increase the chance of a complete cure.

A number of observations were made to ascertain the length of time acari and their eggs can retain their vitality apart from sheep. In crusts and wool kept at room temperature the acari begin to die in three or four days, the young forms first, and are generally all dead in 16 days after removal from the sheep.

When kept moist at body temperature (37° C.) in an incubator the acari are very active for two or three days and eggs present in the crusts hatch. A day or two later the larvae and most of the older forms die and very few survive more than six or seven days.

At 0° C. all forms were dead in four days.

Eggs kept at air temperature for up to, and including, eight days after being laid, hatched out when placed on sheep; after nine days removal one egg hatched out of 20, and after longer periods not one hatched. In an ice box the eggs retained their vitality for 10 days, but after 12 days all failed to hatch. It is thus no longer possible to regard the eggs of acari as being capable of maintaining their vitality for long periods apart from sheep and thus accounting for the persistence of the disease in kraals, etc.

The following table gives the results of experiments undertaken to show the period over which infection with sheep scab parasites may persist:—

Expt. No.	Particulars of Infection.	Interval between Removal of Infected Sheep from Kraal and Contact with Clean Sheep.	Length of time Clean Sheep remained in Contact.	Result.
1	37 Scabby sheep herded in Kraal for 44 days	21 days	76 days	Sheep clean.
2	30 Scabby sheep herded in kraal for 48 days	60 days	16 days	Sheep clean.
3	Do.	90 days	7 days	Sheep clean.
4	37 Scabby sheep herded in kraal for 35 days	10 days	60 days	Sheep clean.
5	Infected sheep running in a kraal for several months	24 days	48 days	Sheep clean.
6	Wool crusts and acari spread in box	Box kept free of sheep for 20 days	4 months	Sheep clean.
7	Acari and pieces of fleece scattered in box	Box kept free of sheep for 15 days	4 months	Sheep clean.
8	Manure collected from a kraal in which infected sheep had been running up to 16 days previously	Clean sheep immediately put into:— (a) clean kraal with manure, (b) above sheep removed after five days and replaced by second lot of clean sheep	5 days 6 months	Sheep infected. Sheep clean.
9	2 Scabby sheep running in a pen for 7 weeks. At the time of removal, pieces of fleece and acari were spread on floor of pen	8 days	4 months	Sheep clean.
10	Do.	12 days	4 months	Sheep clean.

From the above it can be seen that acari are unable to live for more than four weeks apart from sheep.

Investigations showed that the psoroptes causing scab and otacariasis in goats and rabbits could not cause scab in sheep. The converse was equally true.

Variations in the Rapidity of Multiplication of the Acari.—As in Great Britain, great variations in the prevalence of sheep scab in the course of the year are also observable in South Africa. On scabby sheep, maintained at the Laboratory to supply material for experiments, the number of acari was noted to diminish in the spring of each year until, later, they could only be found with considerable difficulty. It is also well known to sheep farmers in very dry areas that, in certain seasons of the year, flocks that have been badly infected may become apparently clean and remain so without any kind of treatment being carried out. When on account of drought the sheep lose condition scab again makes its appearance, although no opportunity for re-infection may have occurred in the meantime.

With sheep in good condition it is frequently found difficult or even impossible to transmit the disease by infection with acari. "In carrying out the observations on the life-history of acari it was frequently noticed that development occurred just as rapidly on the washed and shaven patches on affected sheep as on those in poor condition, but when the covers were removed and when the parasites were allowed to spread to the surrounding skin multiplication was much more rapid in the case of the thin sheep than on those with excess of yolk in their fleece, while in a few of the latter no development occurred at all."

In order to observe the effect upon the acari of the presence of wool fat, two patches were prepared on the same sheep; one was washed and shaved in the usual way, but on the other the wool was only cut short and in addition the patch was smeared with "yolk" obtained from the wool of another sheep. On each patch six ovigerous female acari were placed. It was seen that in both cases eggs were laid on the following day and larvae were present on the fourth day.

On the ungreased patch the development occurred as usual, eggs being laid nine days after the appearance of the larvae, and this cycle was continued for several generations. As each generation of acari began to develop on the ungreased patch, a number of the young forms was removed to a fresh area so that the number of generations could be determined.

On the greased patch, however, the majority of the larvae died two or three days after hatching, while those that survived developed very slowly; thus it was not till 14 days after hatching that adult male and female acari were observed, and although fertilisation took place no eggs were laid, and living acari were not observed after the 21st day from the time of hatching. By this time the fourth generation of acari were developing on the ungreased area.

When the skin was greased very slightly the acari developed as rapidly as on the ungreased area. In these cases, the growing wool lifted the first crusts formed and these carried the fat with them so that the acari were able to live on the dry skin underneath. However, when sufficient grease was present to soak down under the crusts development was very slow and in every case the acari gradually died out, usually in about 20 days.

MYCOLOGY.

(a) ASPERGILLOSIS.

(188) WALKER (J.). *Aspergillosis in the Ostrich Chick.* (Synonyms: Yellow Liver, Chick Fever).—*Union of South Africa. Dept. of Agric., 3rd & 4th Reports of the Director of Veterinary Research.* 1915. Nov. pp. 533–574. With 5 charts & 2 plates, comprising 7 figs. Pretoria: Govt. Printing & Stationery Office.

Chick Fever or Yellow Liver among ostrich chicks reared on some farms in South Africa sometimes causes a mortality as high as 70 per cent. The disease has thus assumed considerable economic importance, inasmuch as prices as high as £200 to £300 may be paid for adults, and £30 for three month-old chicks.

In preliminary observations the author discovered that various moulds, notably of the *Aspergillus* type, were found in the lesions of chick fever and, in exposure experiments, were capable of transmitting the disease.

On a plan outlined by the Director of Veterinary Research of the Union of South Africa, the author carried out further detailed investigations into the nature of the disease, the results of which are summarised in the following conclusions:—

“ 1. *Aspergillus fumigatus* appears in the ostrich, more particularly in the ostrich chick, from a few days to about 3–4 weeks after hatching, and is responsible for the disease in ostrich chicks commonly known as ‘Yellow Liver or Chick Fever.’

“ 2. *Aspergillus fumigatus* is the commoner and more pathogenic species.

“ 3. Outbreaks usually appear in an epidemic form and are more prevalent amongst chicks artificially hatched and reared.

“ 4. *Aspergillus fumigatus* infection occurs in the air chamber of the egg, and is common in straw and other vegetable matter and in soil which has been fertilized with decomposed vegetable matter, such as stable manure, etc.

“ 5. Infected eggs are the chief source of infection of incubators, the liberation of *Aspergillus fumigatus* from the air-chamber taking place either at the time of hatching or when infected eggs are opened in the incubators.

“ 6. Aspergillosis is contracted naturally from:—

“ (a) Infected eggs just previous to or at time of hatching.

“ (b) Infected bedding used in chicks’ sleeping boxes.

“ (c) Infected incubators.

“ 7. Aspergillosis may be transmitted artificially by inhalation and ingestion and intravenous inoculation of cultures.

“ 8. Aspergillus infection occurs chiefly through the respiratory tract, the lungs and air-sacs being the seat of infection.

“ 9. Infection may occur through the digestive tract.

“ 10. *Aspergillus fumigatus* is transmitted from infected to clean eggs through the unbroken shell.

“ 11. The contents of unbroken eggs may escape through the intact shell. In such cases the bacteria which exist in the contents are probably a source of infection of eggs, more particularly those in contact.

“ 12. Spores of *Aspergillus fumigatus* vegetate after passing through the intestinal canal.

“ Prevention consists in the use of:—

“ (1) Non-infected incubators.

“ (2) Non-infected bedding in the chicks’ sleeping boxes.

“ (3) Non-infected eggs for incubation purposes.

“ Boiling water has given satisfactory results in the sterilization of cultures of *Aspergillus fumigatus*. ”

(b) CRYPTOCOCCOSIS.

- (189) MONOD (T.) & VELU. Sur la lymphangite épidémique au Maroc. [Epizootic Lymphangitis in Morocco.]—*Rec. de Méd. Vét.* 1915. Oct. Vol. 91. No. 18. pp. 631-638. With 4 figs.

(1) *Recurrent attacks of epizootic lymphangitis.*—The authors have never seen cases of re-infection, but on the other hand have observed local delayed relapses equivalent to re-infections. Four cases are detailed in which relapses occurred from three to six months after apparently complete recovery from a previous infection.

(2) *Osseous lesions in epizootic lymphangitis.*—Extra-cutaneous lesions are often secondary and the associated abscesses in those cases facilitate diagnosis, or they may be complications of the lymphangitis. In rarer cases these extra-cutaneous lesions may be the only cryptococcic localisations clinically discoverable.

Osseous cryptococcosis was found in 17 out of 159 cases treated in the course of a year. Hitherto, the cryptococcus was not suspected to be the causal agent of these lesions, but it appears in reality to exert a predilection for bony tissues.

Clinically one can distinguish (1) ostites associated with cutaneous lesions and (2) primary ostites.

A description of 17 cases, with photographs of four lesions, is given, in which lesions of localised and diffuse suppurative periostitis, periostoses, suppurative osteomyelitis, hypertrophying ostitis and spontaneous fracture are described, involving various bones such as the maxillae, scapula, sternum and the pelvis. These lesions simulated all the forms of chronic ostitis due to other causes, and might be easily confused with them. The evolution of these cryptococcic ostites is always chronic, and they are most often post-traumatic lesions.

Diagnosis is difficult and can only be settled by means of the microscope.

Prognosis.—Bony lesions constitute the most serious and most refractory of all the localisations. Out of 20 cases of epizootic lymphangitis slaughtered as incurable in a year, 13 had bony lesions.

Treatment should be the same as in cases of typical epizootic lymphangitis. Surgical intervention is only indicated in cases where a sequestrum is formed and good results are then obtained in three cases out of every four. The successful results hitherto obtained in these cases by excision caused one to overlook the fact that the lesions were in reality cryptococcic in origin.

- (190) BRIDRÉ (J.). La lymphangite épidémique en France ; diagnostic et traitement. [Epizootic Lymphangitis in France; Diagnosis and Treatment.]—*Rec. de Méd. Vét.* 1916. Apr. 30. Vol. 91. No. 8. pp. 136-142. With 1 coloured plate.

As a result of the war several diseases, which from their rarity in times of peace had been classified as exotics, have made their appearance in France. Epizootic lymphangitis was observed at the beginning of the campaign in horses belonging to Moroccan cavalry, and there is reason to believe that the disease is African in origin when one considers

its frequency in the French possessions in Northern Africa. The number of cases of the disease that passed through a dépôt seems quite inconsiderable, but the diversity in origin of these cases indicates a rather disquieting diffusion. The disease at present also attacks horses which are civilian property and certain stables appear to be severely affected.

The author describes the diagnosis of the disease and its differentiation from ulcerative lymphangitis (due to the Preisz-Nocard bacillus), and sporotrichosis.

Treatment.—NÈGRE, TROUETTE, and the author have previously published observations on the treatment of this disease by means of intravenous injections of *arsenobenzol*, which they claimed to have furnished excellent results [*Bull. Soc. Path. Exot.*, 1911; *Ann. Inst. Pasteur*, 1912]. In current practice its employment, however, presents some difficulty on account of the material necessary for the preparation of the solutions and injections.

Novarsenobenzol, which gives exactly the same results as the old arsenobenzol, is on the other hand easy to administer. The author recommends a dose of from 2 to 3 grammes dissolved in 20 cc. of distilled water to be injected into the jugular.

“Care should be taken not to allow the escape of fluid subcutaneously as the substance produces a great deal of irritation and pain in the subcutaneous tissues. The effects of the injection are shown afterwards by the cicatrisation of the original ulcers, the diminution in size of the lymphatics, the appearance of new ‘buds’ on the diseased lymphatic system, the softening and spontaneous opening of existing ‘buds.’ The ‘bud’ seems to react by expelling the parasite.”

“In order to appreciate the results of the injection it is as well to wait three weeks. A cure is then assured if the cording of the lymphatics has disappeared or considerably diminished, if they have become painless to the touch, and if the original wound is cicatrised. If, on the other hand, the original wound remains open and the sensitiveness of the lymphatics persists it is better to repeat the injection.”

“It is sometimes advisable to puncture, by means of a bistoury or cautery, certain abscesses in which spontaneous bursting would otherwise be too long delayed, and to assist the cicatrisation of extensive ulcers by painting them with tincture of iodine. Considerably granulating ulcers should be powdered over with copper sulphate or liquid chloride of zinc.”

The author then gives details of nine cases treated as above, all terminating in complete recovery, except one, where, owing to the advanced state of the disease when first treated, recovery was only partial.

(191) DOUVILLE. *Traitemen de la lymphangite épidémiologique. Essais par le galyl.* [Treatment of Epidemic Lymphangitis. Experiments with Galyl.]—*Rec. de Méd. Vét.* 1916. May 30 to June 30. Vol. 91. Nos. 11-12. pp. 144-151. With 4 plates.

Galyl is a definite chemical compound, an organic arsenio-phosphate discovered by Professor MONNEYRAT (formula $C_{24} H_{22} O_8 N_4 P_2 As_4$). Its employment in human medicine for the treatment of syphilis, relapsing fever, and yaws has been recently studied by various authors, while LAVERAN and ROUDSKY in 1913 published experiments to show that the compound was very effective in infections due to *T. brucei*, *T. evansi*, *T. rhodesiense*, and *T. soudanense*. Galyl has the

form of a yellow powder which keeps indefinitely in a closed flask. Its molecule contains 35 per cent. of arsenic and 7·2 per cent. of phosphorus. It is easily soluble in water, forming a transparent yellow or slightly brownish solution.

The author utilised, to commence with, the system of giving fractional doses; an intravenous injection of 90 eg. or a gramme, in a $\frac{3}{4}$ or 1 per cent. solution, being repeated weekly as a rule. Up to 5 grammes, however, of galyl can be tolerated by a horse of average weight without any risk. At present the author gives a preliminary injection of 2 or 3 grammes of the product, according to the extent of the lesions and the size of the patient, and waits a fortnight before repeating the injection. In cases where improvement occurs the second dose does not exceed 1·5 or 2 grammes; in the contrary event, it is equal to the first injection.

All the cases treated by the author with galyl were chosen from amongst the most severely affected and from those cases where effective cauterisation of the lesions could not be applied without risk. The author then gives a history of 15 cases so treated. Eleven cases were completely cured, the total dosage for each having varied from between 3 to 6 grammes and the duration of the treatment from one to three months. Four animals were killed after a month in hospital on account of the extent and severity of the lesions. In the case of these latter animals, the dose injected did not exceed 3·5 grammes, but the author believes that these animals would have remained refractory to a larger quantity of the product. The animals were slaughtered for economic reasons.

Comparatively, the author has tried treatment with *iodides*, which TEPPAZ utilised for the same infection in Senegal. A certain amelioration was observed in the case of treated animals, but in no case could a cure be said to have been effected, although a total dosage of 300 grammes had been given to some animals.

Treatment with *novarsenobenzol*, recommended by BRIDRÉ, was also thus tried. In 12 cases treated, seven animals appeared to be on the road to recovery after having each received an injection of 3 to 6 grammes in the course of a month. In the case of the other five, the lesions seemed to be stationary in spite of the administration of 5 to 11 grammes of the product.

- (192) VELU. *Essai de traitement de la lymphangite épidémiologique par le novarsénobenzol.* [Treatment of Epizootic Lymphangitis with Novarsenobenzol.]—*Rec. de Méd. Vét.* 1916. May 30 to June 30. Vol. 91. Nos. 11-12. pp. 152-155.

The author has had ample opportunity of comparing the effect of various drugs on the very numerous cases of epizootic lymphangitis which occur in Morocco. Contrary to the indications of BRIDRÉ and other workers, who have claimed most favourable results from treatment with novarsenobenzol, the author has found that in his hands this product has given no better results than in the case of the other products hitherto employed, in particular colloidal iodine and biniodide of mercury.

(c) SPOROTRICHOSIS.

- (193) BRIDRÉ (J.). *Sur un cas de sporotrichose du cheval.* [A Case of Sporotrichosis in the Horse.]—*Rec. de Méd. Vét.* 1916. Apr. 30. Vol. 91. pp. 113 to 116.

The author describes a case of the above disease in a French army horse imported from North America. Sporotrichosis of the horse was observed for the first time in 1909 in Madagascar by CAROUGEAU, and has been found in America by various authors, but up to the present no cases have been reported as occurring in France.

The following were the lesions presented by Bridré's case :—

"Excoriation of the left eyebrow ; a circular ulcer with edges radially striated at the base of the left ear, and from this ulcer commences a cord-like beaded swelling, with hard and insensitive 'buds,' ending at the entrance to the chest ; several buds opened by means of a scalpel disclosed a thick cream-like pus. The animal was placed in a box when these symptoms were first seen and tested with mallein, subcutaneously, but gave no reaction. On the following days the wounds on the eyebrow and at the base of the ear showed a tendency to cicatrisation."

Microscopic examination of fresh pus showed two oblong bodies only, bearing some resemblance to cryptococci, but not showing the characteristic refractile envelope of these parasites. The material was sown on to Sabouraud's agar immediately and kept at room temperature. After about 12 days numerous colonies of *Sporotrichum* appeared on the surface of the agar.

At first sight the characters of this organism did not appear to differ sensibly from those of *S. beurmanni*. A precise description is promised by the author's friend, PINOV, who has commenced the study of the organism.

The above case was treated by intravenous injections of novarsen-benzol, with successful results.

BACTERIAL DISEASES.

UNDULANT FEVER.

- (194) IZAR (Guido). *Mutazioni morfologiche culturali e biologiche in vitro ed in vivo del microcoecio di Bruce per azioni dei sali di chinino. Nota Preventiva.* [Morphological, Cultural and Biological Changes *in vitro* and *in vivo* of Bruce's Microcococcus, caused through the Action of Quinine Salts. Preliminary Note.]—*Pathologica.* 1916. June 1. Vol. 8. No. 182. pp. 175-176.

By the addition of gradually increasing quantities of quinine salts to media, Bruce's micrococcus can become accustomed to, and grow luxuriantly on, media containing several times the dose that would be bactericidal to the original strain.

Thus acclimatised it displays the following changes :—(A) Morphological—(increase in size, chain and bacillary forms) ; (B) Cultural—(a greater rapidity of growth, a dense whitish film on surface growth) ; and (C) Biological—(loss of agglutinability towards serum immune

against the original strain of micrococcus, increase of non-specific agglutinability, but specific agglutinability towards an auto-immune serum persists).

The sera of individuals who had undergone quinine treatment and were affected with a low form of Malta fever did not agglutinate the ordinary strains of the micrococcus ; they, however, agglutinated the micrococcus which had grown for several generations on media containing quinine.

The author believes that his strain acclimatised to quinine resembles the *paramelitensis* strain of NÈGRE and RÉNAUD.

- (195) SERGENT (Edm.), NÈGRE (L.) & BORIES (L.). *Epidémie de fièvre ondulante à Arzew et Saint-Leu (Dep. d'Oran, Algérie) en 1915.* [An Outbreak of Undulant Fever in Arzew and Saint-Leu (Dept. of Oran, Algeria) in 1915.]—*Bull. Soc. Path. Exot.* June. 1916. Vol. 9. no. 6. pp. 351-356. With 4 charts.

The department of Oran has always been an active focus of undulant fever although in the departments of Algiers and Constantine the disease has now been reduced to insignificant proportions. In the spring of the year 1915 a further increase in severity of undulant fever, which lent some particularly interesting characters to the circumstances, took place in the localities of Arzew and Saint-Leu. The epidemic broke out from February to May and affected 20 people—13 soldiers out of a total of about 10,000 men, and 7 civilians out of a population of a corresponding number. With the exception of three cases in which the blood was not taken, serodiagnoses were positive—after heating the serum to 56 C. for half an hour—to a high degree : 1/500 and 1/1,000.

The principal symptoms and complications observed in the case of each patient are given by the authors in tabular form.

It is noteworthy that two patients out of 17 had not partaken of unboiled milk or of fresh goat cheese. Six out of 17 did not drink unboiled goat's milk but ate fresh cheese, while 9 out of 17 took raw milk or fresh goat cheese. The duration of the disease varied from 35 days up to 6½ months, and three deaths occurred.

The disease was most serious in the case of the soldiers, since all the deaths took place among them and nearly all the others were incapacitated for a long time.

SERGENT (Edm.) and BORIES found in 1907 that samples of goats' milk gave a positive agglutination in the proportion of 3·3 per cent., and likewise the sera of six other animals (horses, asses, dogs). SÉJOURNANT also made the same observations in 1912. The domesticated animals of this region thus appear to harbour the *M. melitensis* in an enzootic state.

The increase of the epidemic in 1915 was particularly severe, probably because it found a favourable medium in the soldiers who had been rendered more sensitive by change of environment and physical fatigue.

W. H. HORROCKS and the English medical men in Gibraltar have shown that this English possession, contaminated by goats from Malta, contaminated in its turn the neighbouring Spanish towns. In these circumstances, it would appear necessary in the presence of this

persistence of undulant fever in Orania to introduce legislation against the importation into Algeria of goats from Spain, or at least submit them to a careful bacteriological examination.

(b) D'HÉRELLE'S BACILLUS FOR EXTERMINATION OF LOCUSTS.

- (196) MONOD & VELU. Note préliminaire sur la destruction des acridiens par l'emploi des cultures microbiennes. (*Laboratoire du Service Zootechnique et des Epizooties au Maroc.*) [A Preliminary Note on the Destruction of Acridians by means of Bacterial Cultures.]—*Rec. de Méd. Vét.* 1916. June 15. Vol. 92. No. 10. pp. 346-348.

D'HÉRELLE isolated in 1910, from an outbreak of disease among locusts in Mexico, a coccobacillus which was very pathogenic for these insects. The authors have undertaken experiments in certain parts of Morocco with a view to the extermination of locusts by infecting them with this organism, and the results are briefly summarised as follows.

D'HÉRELLE's method provokes very contagious outbreaks among insects either by the dissemination of broth cultures or by contamination with the aid of infected crickets. The contagious enteritis provoked by the coccobacillus among the crickets behaves in the same manner as other epizootic diseases. After a period of incubation one observes a period in which a variable mortality occurs ; then a period of decline sets in with a diminution of morbidity, caused either by attenuation of the virulence of the organism or by increase of resistance of individuals. In the most favourable cases one notices a mortality of 70 to 80 per cent. In other cases the mortality does not exceed 20 to 25 per cent.

D'HÉRELLE's method is very difficult of application, and good results can only be obtained by competent technicians. Moreover, unfavourable atmospheric conditions such as rain, heavy dews, or bright sunlight considerably hamper the efficacy of the method. It would also be difficult to spread pure broth cultures over a large extent of territory.

The results, however, have been very encouraging and the authors are prepared to adopt the method on a large scale when future invasions by locusts occur.

DISEASES DUE TO ULTRA-VISIBLE VIRUSES.

(a) VARIOLA.

- (197) (1) MONOD & VELU. La variole des porcelets au Maroc. Premiers essais de vaccination. [Variola of Young Pigs in Morocco. First Attempts at Vaccination.]—*Rec. de Méd. Vét.* 1915. Sept. 15. Vol. 91. No. 17. pp. 570-573.
 (2) VELU. Contribution à l'étude de l'étiologie de la variole des porcelets. [The Etiology of the Variola of Young Pigs.]—*Ibid.* 1916. Jan. 15 to Feb. 15. Vol. 92. Nos. 1 & 2. pp. 24-27.
 (3) VELU. Recherches expérimentales sur la variole des porcelets. [Experiments on the Variola of Young Pigs.]—*Ibid.*, pp. 28-30.

In these three short essays a description is given of the authors' observations and work on the variola of young pigs in Morocco.

The disease is very common in that country and causes considerable ravages among young pigs.

According to POENARU, the disease has been demonstrated to be due to a filterable virus. BOLLINGER states that it may emanate from either cow-pox or sheep-pox, thus producing local or general symptoms respectively. PEIPER states that small-pox of man is transmissible to the pig, and vice versa. The authors, however, state that no sheep-pox or human small-pox existed in districts where the variola of pigs occurred, and that though no precautions were taken in handling the sick the disease was not transmitted to human beings; and also, laboratory experiments showed that the infection of young pigs with pig variola did not give subsequent protection against the infection with cow-pox virus.

The virulence of the disease is very variable. The mortality ranges between 5 and 80 per cent., and the virulence in the course of several years apparently undergoes increasing modifications, that is exaltations and attenuations, giving rise to various degrees of illness (benign, generalised, and septicaemic forms). The reason for this is not known. The disease occurs in all seasons, but more especially in winter. The virus is known to be preserved in the dried-up crusts that are shed from the skin, and this probably explains the annual re-appearance of the variola in infected piggeries during the farrowing season.

Up to the age of 3 or 4 weeks, young pigs are so susceptible that nearly all are attacked during an outbreak. After the age of 2 months they often remain insusceptible, whilst one very rarely meets infections of adults. In the latter case, the disease is always very benign and localised about the teats and ears, and is caused, no doubt, by the sucking pigs.

The rabbit, the guinea-pig, and the rat are immune.

Most of the body tissues of an infected animal are virulent, but the cutaneous lesions seem most apt to transmit the infection. The virus is abundant in the eruptions immediately papules are formed, and it still exists when the secretions become purulent.

The patient itself is the most important factor in the transmission of the disease, but this does not explain the appearance of outbreaks with no direct history of original contagion or apparent importation. It sometimes appears that dust may be an important factor, and the authors have known instances where outbreaks were spread through the country in the direction of the prevailing wind.

The period of incubation is not known. Following variolisation the first lesions appear in three or four days. In natural cases, however, pigs are doubtlessly infected by ingestion or inhalation, and thus the incubative period would be a good deal longer.

Symptoms.—Young pigs as a rule present grave general symptoms of depression, wasting, high fever, and sometimes diarrhoea. The vesico-pustular eruptions, which are more or less generalised on the skin, are evolved in 15 to 30 days and are rather haemorrhagic in character. The evolution of the skin lesions corresponds with that of human small-pox. Often, vesicles appear about the eyes and conjunctival mucous membrane, and may involve loss of the eyes. The lymphatic glands of the head and neck are very enlarged and softened. When the disease persists in a place, one often notices subcutaneous pustules about the size of hazel nuts containing creamy pus, and in

the region of the neck these sometimes may become as large as hens' eggs and involve the periosteum of the adjacent bones, later forming persistent fistulae.

The disease ordinarily lasts $1\frac{1}{2}$ to 2 months in each centre of infection. There also exist septicaemic forms in which the disease runs a very rapid hyperacute course lasting only two or three days, and in which one only finds localisations about the head and mucous membranes, especially of the eyes. In fifteen to twenty days the whole of the young pigs in a place may be destroyed.

On post-mortem examination, one finds, in nearly all cases of the disease, a lobar pneumonia with abundant oedema.

When the disease breaks out it is impossible to predict the probable duration of the outbreak. After each case, the animals which have shown symptoms or have developed unnoticed pustules remain a source of infection. When the disease is localised it is always cured. When the eruptions become confluent and involve the mucous membrane the prognosis is very serious. It is always fatal in septicaemic forms. A certain number of infected animals show secondary symptoms, waste away, and die from lung complications. All animals which are seriously affected and recover remain for a long time "bad doers."

Preventive Inoculation or "Variolisation."—The authors find that the best material is obtained from vesicles three days after the commencement of symptoms. Before the second day no result is obtained, and later the products are purulent. The lymph is taken from a not too severe case of the disease. Conditions in the field are unfavourable for the preservation of the virus, hence the lymph pulp from the vesicles is inoculated immediately.

The seats chosen for inoculation are the inside of the thighs or the region of the folds of the groin. These are lightly scarified and the pulp applied. Three days after scarification the typical pustules of a benign variola appear and these always remain discrete and strictly localised. After recovery young pigs become immune.

(198) HARDE (Edna S.). *Some Observations on the Virus of Vaccinia.*
—*Ann. Inst. Pasteur.* 1916, July. Vol. 30. No. 7. pp. 299–306.

"Summary.—A pure active virus of vaccinia can be obtained by repeated partial disinfection with carbolic acid and glycerin.

"The virus of vaccinia incubated in tissue cultures composed of plasma and cornea or testis from normal rabbits or guinea-pigs shows a definite increase, but the degree of multiplication is not comparable to that observed in cultures of rapidly growing bacteria. The increase of the virus occurs mainly in the tissue, but very little in the surrounding plasma.

"The multiplication of the virus occurs without a corresponding development of vaccine bodies in the preparations.

"There is no growth of the virus in preparations containing cornea killed by freezing or by hypotonic salt solution.

"There is no evidence of the growth of the virus in preparations in which pieces of paraffin, heart, liver or kidney have been substituted for the cornea or testis.

"The virus is soon rendered inactive in preparations containing plasma and cornea obtained from an immune rabbit. The greatest lytic action is exerted by the plasma.

"Attempts at confirming Fornet's cultural experiments have been unsuccessful.

"Cultural experiments with other media and methods have also given negative results, although the virus has not been killed by incubation for eight weeks at $33^{\circ}\text{C}.$ "

(b) RABIES.

(199) CARPANO (Matteo). *Su di un metodo rapido di colorazione dei corpi di Negri nella rabbia e sulla speciale struttura che si mette in evidenza col metodo stesso.* [A Rapid Method of Staining Negri Bodies and the Special Structure of these Bodies brought out by this Method.]—*Clinica Vet.* 1916. June 15-30. Vol. 39. Nos. 11-12. pp. 347-359. With 2 plates comprising 38 figs.

After reviewing the methods hitherto employed for staining Negri bodies, Carpano details the following technique.

Smears from the hippocampus are fixed either in absolute alcohol or, better, in Zenker solution. In the latter they are left for from four to five minutes, washed and again placed for a few minutes in iodised alcohol.

For the preparation of sections small pieces of hippocampus about $\frac{1}{2}$ cm. in thickness are taken. To obtain the quickest results, they are fixed by placing them in acetone, which should be changed two or three times in the course of about two hours and kept at 37° C. The pieces are then clarified in xylol for 10 to 15 minutes and then placed in paraffin, fusible at 50° to 52° C., and kept at 55° C. for about an hour. Absolute alcohol can be used instead of acetone but fixation takes about double the time.

In order to study the histology of Negri bodies the best results are obtained by fixing in Zenker's fluid for four or five hours, then carefully washing in running water, and afterwards immersing for an hour in diluted iodised alcohol; the piece is then put in xylol at 37° C. for an hour, and then for two hours in paraffin wax fusible at 50° to 52° C., heated to 55° C.

STAINING.—The following solutions are employed :—

(1).—*Eosin.*

Eosin red (ethyl) or, better, eosin yellow ..	1 grammie.
Distilled Water	100 cc.

(2).—*Crystal Violet.*

Crystal violet	1 grammie.
Alcohol (95 per cent)	20 cc.
Dissolve and add a solution of 2 per cent. phenol in distilled water	500 cc.

(3).—*Iodine.*

Iodine	1 grammie.
Potassium iodide	2 grammes.
Distilled water	400 cc.

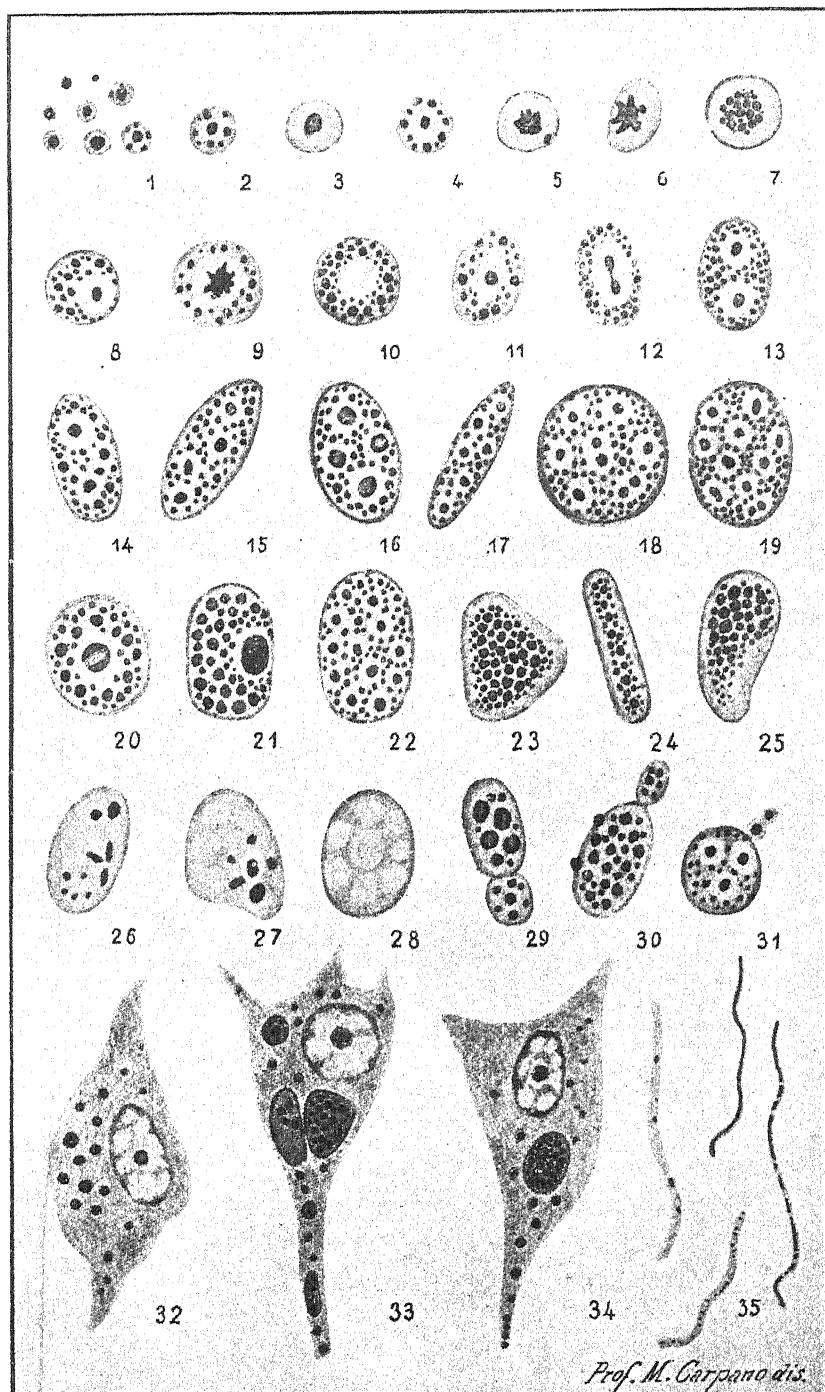
The following are the directions for staining :—

(1) About 10 drops of eosin (Solution 1) are placed on the smear or section for about one minute, run away, and without washing passed quickly into 95 per cent. alcohol.

(2) Before the slide is allowed to dry it is covered with about 10 drops of the crystal violet (Solution 2); the preparation is gently warmed until vapours begin to rise for about five minutes.

(3) The above stain is shaken away from the slide and without previous washing a few drops of the iodine (Solution 3) are put on and left for one minute.

(4) The last named fluid is then also shaken away and the preparation placed for a few seconds in 95 per cent. alcohol until the violet colour has almost completely disappeared.



Prof. M. Carpano dis.

(5) The preparation is passed quickly through absolute alcohol, clarified in xylol and mounted in Canada balsam.

By this method of staining the cellular elements appear more or less pale pink. The Negri bodies stand out distinctly as they stain of a very dark, decisive, violet colour. Under the low power of the microscope they look almost black, but under moderate and high magnifications they show distinct outlines and a granular interior which is not very clear on account of the intensity of staining.

Better internal differentiation, which is not necessary when staining for diagnosis, is obtained by substituting for the eosin solution a 1 per cent. solution of methylene blue. The specific bodies are then stained dark violet on a cellular basis which is pale blue.

The only elements which are stained in the same way as the Negri bodies are the nucleoli of the great pyramidal cells; these, however, are very easily distinguished on account of their not very distinct outline, constant size, and position in the interior, and often in the centre, of the cell nuclei.

The advantages claimed for this method of staining, besides its rapidity are (1) that it brings out the smallest forms of Negri bodies which are invisible by other methods, and (2) that it reveals their particular structure. One can see a progressive growth and follow a very probable evolution of the structures, and this tends to show that the bodies themselves are of a parasitic nature.

This growth and evolution can best be seen from the following reproduction of one of the Plates.

EXPLANATION OF PLATE.*

1. Negri bodies in sections and smears of hippocampus of rabid dogs. Stained by the above method, drawn exactly as seen under the microscope and arranged according to probable development. Figs. 1 to 31 are magnified about 2,000 diameters; the remainder are magnified 800 times diameters.

Fig. 1. Initial forms and forms in the act of developing.

Figs. 2 and 4. Bodies in which granules derived from the primary nucleus are already abundant.

Figs. 3, 5 and 6. Elements in which the primary nucleus has remained undivided and acquired a different appearance.

Figs. 8 and 11. Forms in which the primary nucleus has become surrounded by an appreciable colourless halo.

Fig. 9. Element with central nucleus in form of star.

Figs. 7 and 10. Incomplete figs. as sections were not cut through centre of bodies.

Figs. 12 and 13. Forms in which the central nucleus appears in the act of dividing or else completely divided.

Figs. 14 to 22. Bodies in which rapid division of the nucleus has taken place; the greater part of the small nuclear masses are surrounded by clear halos.

Figs. 23 to 25. Elements in various forms containing large quantity of granules of various sizes.

Figs. 26 and 27. Bodies with a few nuclear granules irregularly distributed.

Fig. 28. Forms showing absence of nuclear masses and a distinctly vacuolated appearance.

Figs. 29 to 31. Bodies apparently undergoing gemmation. Fig. 30 shows at the same time the probable extrusion of nuclear granules.

Figs. 32 to 34. Large pyramidal cells containing Negri bodies in various forms and sizes; in the dendrites will be noticed more or less well-developed elements some of which are very small and arranged in beaded form.

Fig. 35. Filaments observed between the nerve cells, with contents showing various appearances.

* Reproduced by permission of the Editor of *La Clinica Veterinaria*.

(c) EQUINE INFECTIOUS ANAEMIA.

- (200) THEILER (A.) & KEHOE (D.). Infectious or Pernicious Anaemia of Equines in South Africa.—*Union of South Africa, Dept. of Agric. 3rd and 4th Reports of the Director of Veterinary Research.* 1915. Nov. Pretoria: Govt. Printing & Stationery Office, pp. 215-289.

Prior to the experiments described in this article by the authors, the above disease was not known to exist in South Africa. It was probably confounded with "biliary fever" (Nuttalliosis, or equine piroplasmosis), or horse sickness, especially in the form observed when an animal had passed through a previous attack and gained a relative amount of immunity, and probably also with the "ephemeral fever" described by THEILER.

The manner whereby the authors came to recognise the existence of infectious anaemia is described by them in the protocols of a number of exceedingly involved experiments. These experiments were originally carried out with a view to ascertaining the relative virulence of some newly collected strains of horse sickness, in order to find out which would be the most suitable in the immunisation of horses against horse sickness, and also to see which strain was the most virulent. This was done by intravenous inoculation into horses which had passed through one or more attacks of horse sickness (immune animals), and horses which had repeatedly received very large doses (10 litres of horse sickness blood intravenously) (hyper-immune horses).

Seventy-six hyper-immune, and four immune horses were available for these tests.

Expt. 1 (10th Oct., 1913.)—The above horses were divided into 10 lots and 10 newly collected strains of horse sickness were tested, by intravenous inoculation of 10 cc. of blood per horse, on respective lots. The results showed that five of these viruses did not cause reactions, while five viruses did; of these latter, three not only caused temperature reactions but even produced death from horse sickness in one case at least each, and one temperature reaction with "dikkop" each.

Expt. 2 (27th Oct., 1913.) (A) The viruses from the reacting horses of Expt. 1 were tested on horses of other reacting groups or lots, and where only a temperature reaction had been shown the virus was tested on a control animal in order to prove its capability of producing horse sickness.

Eight viruses (2nd generation) were thus tested.

It became noteworthy that four out of seven horses which had been inoculated in this manner with a certain virus (McCall 59) in Expt. 1 revealed, in the course of this second experiment, reactions which must be considered due to the first injection in Expt. 1. Temperature reactions which continued for 12 days or more were observed either before, or a day or two after, the second inoculation. (The mother virus, however, when tested on a susceptible animal produced death from horse sickness.) The daughter virus of this strain used in inoculating a group in this second experiment failed even to kill a control animal; it produced temperature reactions in the other animals and death in the case of one, which commenced reacting on the 17th day and died on the 31st, death being at the time attributed to broncho-pneumonia. The tardy reactions produced by this virus

(McCall 59) (used in Expt. 1) in the course of the second experiment the puzzled the authors on account of the clinical symptoms shown by horses, which did not resemble those of horse sickness or biliary fever.

(B) Eight additional new strains of virus were tested on the horses of those groups in Expt. 1 which had shown no reactions. It was found that three of these new viruses were capable of producing death from horse sickness in one animal in each of their respective groups, and in one animal of each group, of producing reactions accompanied by "dik-kop." The others either did not react or else produced reactions the nature of which was not understood at the time by the authors.

Expt. 3 (13th Nov., 1913).—The properties of three viruses from the first inoculation and three from the second inoculation, all obtained from horses which had died of horse sickness, and three viruses produced from the second inoculations which had given reactions of varying intensity, were tested in the same way on hyper-immune horses of other groups, using also control animals for the last three viruses.

Expt. 4 (21st Nov., 1913).—This was a test of the properties of the McCall virus produced from the second experiment.

The results of Expt. 3 and Expt. 4 showed that certain viruses other than the virus McCall were capable of producing a similar type of reaction and that in these new cases the incubation period might also be a long one (otherwise it would have to be considered too short). For example, the reaction which appeared on the first day after inoculation with a virus (Dunning) in the third experiment should be really considered due to the effects of virus (Onderste poort) inoculated in Expt. 2, eighteen days previously; reaction which appeared on second day after inoculation in this experiment with virus (York) should be considered due to the virus (McCall 59, 2nd generation) inoculated in Expt. 2 nineteen days previously. Other similar reactions were produced which were unfamiliar to the authors and they concluded that some other disease was the factor in producing these results. Temperature reactions even appeared on the 37th day in controls from Expt. 2, and these animals did not die of horse sickness. When tested, however, later with known horse sickness strains they died of that disease.

Controls were inoculated with blood from eight of the horses that had shown reactions in Expts. 1, 2, and 3, and that had not yet been tested to see whether they were really capable of producing horse sickness. Six died of horse sickness, and of the remaining two, one died accidentally on the 18th day, having shown no reaction prior to death, and the other horse showed a temperature reaction from the 5th to the 8th days but did not die of horse sickness.

Expt. 5.—Here a study was made of the properties of three viruses, viz.:—

Dunning, 2nd generation, Martin, 2nd generation, Onderste poort, 1st generation, by injecting them into horses of Expts. 1, 2 and 3 that had not previously received injections of the same viruses (18, 18 and 20 hyper-immune horses for each virus on 5 : 11 : 13, 6 : 11 : 13, and 17 : 11 : 13 respectively).

In considering the results of this experiment the authors state definitely that they were now dealing with pernicious anaemia. Nearly

all the horses inoculated with the first of these viruses succumbed to pernicious anaemia, some of those inoculated with the second virus died of the same disease, while most of those inoculated with the third virus also gave typical reactions. The date of death varied very considerably, the period intervening between the time of last injection varying from 26 to about 150 days, while a good many apparently recovered.

Further experiments were made in order to attempt to transmit the disease to animals of other species than the horse, to test the filterability of the virus, and to transmit the disease by administration of blood of affected animals by the mouth, and to transmit the disease by means of the urine of affected animals. The results of these experiments are given in the following remarks of the authors:—

"The general conclusions that therefore appear to be warranted from the results of the foregoing experiments are, that this disease appearing in horses is capable of being transmitted to other horses by the inoculation of the blood or serum of affected animals; that the virus present in the blood or serum of affected animals is capable under suitable conditions of passing through the pores of a Berkefeld filter; that the disease can be transmitted to the mule and the donkey; that we were unable to transmit it to cattle, sheep, goats, or dogs under the conditions of our experiments; and that it could be experimentally transmitted to horses by the administration through the mouth of blood or urine of affected animals when relatively large quantities of these fluids were used.

"The period of incubation of this disease following inoculation may be as short as five days, but, varying between this and twenty-five days, incubation periods of from ten to fifteen days are not uncommon, and in one instance the length of this period appeared to be thirty days. Further, the length of this period does not seem to be in any direct relationship to the type of disease which follows.

"A point of marked interest, however, to which we wish to draw attention is the relationship existing between this disease and horse-sickness, since it has been suggested by certain European workers that infectious or pernicious anaemia possibly represents a modified or mild form of horse-sickness, a suggestion which appears to have been based on an observation that a horse recovering from pernicious anaemia later proved refractory to infection by a particular strain of horse-sickness virus with which it was injected. The evidence on the point, however, was regarded as inconclusive, and, to our knowledge, no definite evidence for or against this view has since then been brought forward.

"Our experiments bear directly on this point, and furnish evidence to show that this view above referred to is incorrect, since the majority of horses in which the disease was produced in these experiments were horses not only immune to different virulent strains of horse-sickness virus, but animals which had even been hyperimmunized, to the extent of 10 litres given intrajugularly, with the virulent blood of horses, passing through horse-sickness reactions induced by the injection of markedly virulent strains of horse-sickness virus.

"We, therefore, from our experiments cannot support the view that infectious or pernicious anaemia represents a modified mild form of horse-sickness, but are forced to regard the two diseases as entities separate and distinct in themselves.

"Another point which the consideration of our experimental observations bring us to remark upon, and which may be noted here, is the apparent unsuitability of the terms infectious or pernicious "anaemia" as descriptive appellations of the disease, for although the disease is definitely infectious, and anaemia is apparent in the chronic form, still anaemia is not necessarily a well-marked clinical symptom in animals suffering from the more acute form of the disease or in those animals which, though clinically recovered, may yet remain virus "carriers" or "reservoirs."

"This latter observation in regard to the absence of anaemia in acute cases is one to which reference has also been made by other investigators,

but we have here retained the names of infectious or pernicious anaemia to denote the disease as being names by which it is already widely known, and under which it is most commonly referred to in the literature dealing with the subject."

A discussion of the symptoms presented in infectious anaemia of equines is given, the acute, sub-acute, and chronic forms being separately treated. This description would apparently apply to the experimental cases observed by the authors as no record of naturally infected cases is given.

Instances are described where the blood of animals apparently clinically recovered remained infective for a long period.

Drugs such as formalin, iodine, and arsenical preparations exerted no curative effects.

A careful description of the post-mortem appearances of animals which had died from the disease in various degrees of severity is given. No characteristic lesion is, however, discoverable.

The authors devote a considerable amount of work to a study of the appearance of the bone marrow, as European authors and the Japanese Commission had insisted that considerable changes took place in this tissue. The bone marrow from the femur and humerus of 201 animals which had suffered from a variety of diseases were carefully examined. The results showed "that the appearances met with in the bone marrow of animals dying from pernicious anaemia may also be met with in animals coming to post-mortem as a result of various other conditions, and therefore cannot be regarded as especially characteristic lesions of the former disease."

Twelve pages are next devoted to the literature dealing with the disease.

Problem introduced by the disease into the production of horse sickness anti-serum, and methods used for diagnosis of the disease.

In naturally infected cases, the other two diseases which commonly affect equines in South Africa, viz., horse sickness, and biliary fever, can be distinguished from infectious anaemia without any great difficulty. Under experimental conditions following the injection of horses, already immune, with horse sickness virus one meets with cases where febrile reactions are encountered which at first present a little difficulty in diagnosis. The further progress of the cases and the presence or absence of repeated febrile attacks and other symptoms of sub-acute or chronic forms of infectious anaemia serve to distinguish the diseases. Ephemeral fever is similarly distinguished.

In the manufacture of horse sickness anti-serum the following precautions are now observed. The temperature of the "virus" horse is taken regularly morning and evening for from four to six weeks or longer before its blood is employed for injecting a "serum" horse. The "serum" horse is also kept under temperature observations the whole time it is used in serum production and even for six or seven weeks following the last hyper-immunisation. The serum obtained from individual "serum" horses is kept in separate vessels for several months before mixing. Should a "serum" horse show a temperature reaction at any time following hyper-immunisation, the blood or serum previously obtained from it is injected into a susceptible horse, and if the disease then appears in the latter animal the serum obtained from the former is rejected and

destroyed. If a number of "serum" horses show suspicious reactions a collective test is first made by injecting a mixture of the suspected sera into a susceptible horse, and if the result of this test should prove to be negative no further test is performed; if, however, it proves to be positive then further tests are carried out in order to isolate the individual infective sera or serum.

The cost in serum production is thus considerably increased, for whereas previously 67 per cent. of hyper-immunised horses became available for bleeding, now the percentage is further reduced owing to the rejection of animals infected with infectious anaemia.

(201) CARRÉ & VALLÉE. *Sur l'étiologie de l'anémie infectieuse du Cheval.*—[The Etiology of Equine Infectious Anaemia.]—*Rec. de Méd. Vét.* 1916. Apr. 15. Vol. 92. No. 7. pp. 193–199.

In this note the results of work undertaken in the course of the last 12 years by the authors are summarised, and reference is made to the work of distinguished observers who have since confirmed the authors' original findings incriminating an ultra-visible virus as the causal organism of the disease.

*SEYDERHELM (K. R.) and SEYDERHELM (R.), and also RIES have recently, however, ascribed the cause of infectious anaemia to a poison (*oestrine*) contained in the bots of the horse (*Gastrophilus equi* and principally *Gastrophilus haemorroidalis*). They arrived at this conclusion because, when aqueous extracts of these larvae are injected into the horse, there are produced either acute fatal accidents or else a progressive chronic disease accompanied by anaemia and fever.

Carré and Vallée were unable to demonstrate this property in bots collected by them, and the Japanese Commission, which undertook the study of the disease, was no more fortunate. They further refuse to admit the unicity of pernicious anaemia of the horse, and that the disease is only verminous in origin.

The following are the main points which they bring forward to prove that there exists in the equine species an infectious anaemia of an inoculable bacterial nature due to a filterable virus.

(1) Nearly all the horses affected with anaemia kept by the authors for their experiments did not contain bots or verminous aneurisms. Whilst the geographical distribution of infectious anaemia is limited, bots and strongyles can be found in abundance in innumerable healthy horses and in places where infectious anaemia has never been known to exist.

(2) The "poison" of bots discovered by K. R. and R. SEYDERHELM is resistant to heating in the autoclave for one and a half to three hours and is unaffected by alcohol, acetone, ether, chloroform and iodine-trichloride. The virus of infectious anaemia is destroyed by heating to 60° C., and this has been confirmed by OSTERTAG, MAREK, the Japanese Commission, etc.

(3) In their experiments the authors were able to realise five successive "passages" of the infection from horse to horse. It has

* [K. R. & R. SEYDERHELM, *Die Ursache der perniziösen Anämie der Pferde (Archiv. für exper. Pathologie u. Pharmakologie.* 1914. Vol. 76. p. 149–201.)]

never been demonstrated to their knowledge that an intoxication of verminous origin can thus be transmitted in series. K. R. and R. SEYDERHELM, however, maintain that "oestrine releases without doubt an ultra-visible organism which remains inactive in the horse's body until this poison gives it power of propagating, and virulence." They are thus brought round in a tortuous manner to admit the intimate virulent nature of infectious anaemia. (The role of insects in the transmission of the disease has not yet been worked out.)

(d) SWINE FEVER.

- (202) KING (W. E.) & DRAKE (R. H.). The Antigenic Value of Spirochaeta *Hyos* in Complement-Fixation Tests on Hog-Cholera Sera. Studies on Hog-Cholera.—*Jl. Infect. Dis.* 1916. July. Vol. 19. No. 1. pp. 46-62. With 5 charts.

The antigen employed in these tests consisted of an alcoholic extract of *Spirochaeta Hyos*, obtained from pure cultures of the organism. The latter is stated to be present in the intestinal ulcers, caecal crypts, and external local lesions of animals suffering from hog-cholera and has been previously described by the authors in a number of publications.

The authors insist on a careful titration of the materials used for the test. With this antigen, the authors have performed a series of 115 complement fixation tests. Of these, 22 were with normal hog sera from ten different animals, one was with serum from an animal which exhibited a reaction only following inoculation with virus, six with sera from two convalescent or naturally immune swine, 84 with sera from 24 animals suffering from hog-cholera, and one test each was made with two different lots of hyper-immune serum. The animals suffering from hog-cholera had been infected with virus from five different strains obtained from different parts of the United States.

The results, which are recorded in tabular form, show that haemolysis (-) occurred in all cases in which normal hog sera were used whilst complement fixation (+) resulted in all tests with sera from cholera hogs, except in two cases.

Further experiments showed that complement fixation commenced to appear at about the same time as the clinical symptoms, and that the time of its appearance depended on the virulence of the infective material and the individual resistance of the animal.

Another experiment indicated that the complement-binding substances ceased to exist in the blood when immunity against hog cholera became fully established.

The authors undertook control tests with the following antigens:—(1) *B. cholera-suis* (received from Theobald SMITH), (2) *B. voldagsen* (received from HAENDEL), (3) *B. typhi-suis* (GLAESER). (4) *Sp. hyos* antigen. Entirely negative results were observed when the first three antigens were used whereas pure *Sp. hyos* antigen gave positive results.

In order to test the specificity of the *Sp. hyos* antigen the authors procured sera from pigs which they had infected experimentally with the following diseases:—(1) *Staphylococcus* septicaemia, (2) *B. cholera-suis* infection, (3) Anthrax, (4) Ghon-Sachs bacillus infection, (5) Brine or salt poisoning and pneumonia. The antigen possessed no complement binding properties when brought into contact with the above sera.

(203) DORSET (M.) & HENLEY (R. R.). Production of Clear and Sterilised Anti-Hog-Cholera Serum. (Preliminary paper.)—*Jl. of Agric. Res.* 1916. May 29. Vol. 6. No. 9. pp. 333-338. With 2 tables.

In the United States the anti-hog-cholera serum of commerce for the most part consists of defibrinated blood of hyper-immunised pigs, this practice being adopted owing to the difficulty experienced in separating the serum from the fibrin and the blood corpuscles.

When allowed to undergo spontaneous coagulation one finds in practice that not more than 30 to 35 per cent. of serum can be secured from the blood, the remainder of the serum being held firmly within the large clot.

Owing to the occurrence of foot-and-mouth disease in the United States and the accidental infection of certain lots of anti-hog-cholera serum and virus with this disease, it was found necessary to adopt some method of treating these products which would serve to remove the possibility of either of them being a medium for its dissemination. There would seem to be only one means by which the serum might be sterilised in so far as the virus of foot-and-mouth disease is concerned, and that is by the application of heat. Heating to a temperature of 50° C. for 12 hours kills this virus, and it has been shown that defibrinated hog-cholera-immune blood may be so heated without destroying the anti-bodies or altering the physical character of the defibrinated blood. In practice this process is difficult and expensive to carry out.

When defibrinated hogs' blood is subjected to centrifugalisation (force equivalent to 1,700 times gravity for 20 to 30 minutes), a yield of about 50 per cent. of serum is ordinarily secured. The serum thus obtained is usually cloudy, and owing to the fact that the red blood corpuscles are not firmly packed together it is impossible to remove all the serum without at the same time carrying over some of the red cells.

In order to overcome the above difficulties the authors have used an extract of the seed of different varieties of the common garden bean (*Phaseolus multiflorus* and *P. vulgaris*). Extracts of these beans are known to possess the property of agglutinating the red blood corpuscles of the pig's blood and they are said to be non-toxic. Very minute amounts of the extract of these beans serve to agglutinate large quantities of the defibrinated blood, and when such agglutinated blood is centrifugalised the red cells are packed together forming a rather stiff jelly-like mass and a yield of 50 per cent. of serum may be separated. The serum thus obtained is clear and may be readily poured from the tube.

In order to secure a greater yield of serum and a more firmly packed clot of red corpuscles, the authors further recommend the addition of 1 per cent. of sodium chloride to the defibrinated hog's blood after agglutination caused by the addition of bean extract has begun. This will increase the yield of serum from 50 per cent. without salt to 70 per cent. when salt is added.

The authors recommend the following technique for the preparation of clear sterile serum heated to avoid the possibility of foot-and-mouth disease infection.

Preparation of bean extract.—100 grammes of coarsely ground white navy beans are allowed to soak for one hour in 500 cc. of distilled water with occasional stirring; the mixture is then strained, and filtered through a bacteria-proof filter.

Preparation of defibrinated blood for centrifuging.—1 cc. of sterile bean extract is added to each 100 cc. of the cool defibrinated blood, stirred, and then allowed to stand until agglutination commences, which is usually apparent within five minutes of adding the extract. One gramme of finely powdered sodium chloride is then added, stirred in until dissolved, and the mixture is then allowed to stand for about 15 minutes.

Centrifuging.—The defibrinated blood mixture is centrifuged for 15 minutes at a speed sufficient to produce in the cups a precipitating force equal to approximately 1,700 times gravity. The serum is then poured from the cups into suitable containers.

Heating the serum.—The vessel containing the clear serum is placed in a suitable water bath maintained at a constant temperature of 60° C. for 30 minutes. The serum is then rapidly cooled and one part of a 5 per cent. solution of phenol is added to every nine parts of serum.

Filtering the serum.—After the addition of phenol a slight precipitate sometimes forms in the serum, and it is thus desirable to allow several days to elapse between the addition of phenol and the final filtration through a bacteria-proof filter of infusorial earth.

An experiment in which ten pigs were used demonstrated that the amount of anti-bodies left behind with the red blood corpuscles was negligible, as the latter, when injected subcutaneously even in large quantities, failed to produce any immunity against the hog-cholera virus. Also, there was hardly any difference between the degree of immunity conveyed by the serum alone, and the defibrinated blood. This showed that the serum may be heated for half an hour at 60° C. so as to safeguard against infection with foot-and-mouth disease without any noticeable impairment of its potency.

DIETETIC DISEASES, ETC.

- (204) GRAHAM (R.) & HIMMELBERGER (L. R.). *Studies in Forage Poisoning. III.—Jl. Comp. Path. & Therap.* 1916. June. Vol. 29. Pt. 2. pp. 107-116.

This article is a continuation of the authors' studies on forage poisoning.

Considerable losses were caused among cattle and horses in Kentucky fed during the winter months on silage. Bacteriological examination of this (N.) silage revealed the presence of a micro-organism similar to that previously isolated by the authors from an oat hay, which was shown to possess pathogenic properties.

This micro-organism occurred in the form of a short bacillus 1 to 2 microns long by 0·4 to 0·5 microns broad, motile, spore-producing, staining with the ordinary anilin dyes, Gram-negative, and aerobic.

The authors describe 14 experiments on cattle, horses, sheep, goats, and small laboratory animals. In these experiments feeding and inoculation tests were carried out with silage, watery extract of silage, cultures of the bacillus, and sterile filtrates from cultures. The results of these experiments are included in the following conclusions:—

"A bacillus isolated from N silage possessed pathogenic properties towards some experimental animals. We were unable to demonstrate its fatal character for all of our experimental animals. Calves No. 5 and No. 7 furnish evidence of its pathogenicity. The remaining calves and two mature cows are suggestive of the transitory effects exercised by this organism, while horses seemed most susceptible and guinea-pigs and rabbits were apparently immune. We are not in a position to say that similar results could not be attained with other bacteria isolated from apparently poisonous forage or even with bacteria isolated from wholesome forage."

"Daily administrations of sterile filtrates of this bacillus grown on a synthetic medium, introduced intrajugularly, and bouillon cultures in the form of enemas, produced death in horses, as did also daily drenches of bouillon cultures to calves, with clinical manifestations and gross anatomical changes not unlike those observed in some cases of forage poisoning."

"The morphological and cultural features of this bacillus are in every major detail analogous to those possessed by a pathogenic organism isolated from an oat hay responsible for losses among horses and mules, as demonstrated by feeding experiments. The possibility of this bacillus being closely related to the spore-bearing bacillus from a different source, described in a previous publication, is further suggested in experiments on horses by the manifestation of similar symptoms and *post-mortem* lesions after death. A poisonous substance is evidently produced by the bacillus in question, since sterile filtrates of cultures grown on Uschinsky's medium produced death in horse No. 62, as well as other experimental horses not recorded in this paper. The symptoms following intravenous injections are quite sudden and intense, yet not unlike those observed subsequent to intestinal or rectal absorption in calves and horses. In a control experimental horse no unfavourable results followed the daily intravenous injection of similar quantities of sterile uninoculated Uschinsky's medium or daily enemas of sterile bouillon. It is at least a suggestive contribution to our knowledge of forage poisoning that a bacillus may be associated with silage which on being cultivated on synthetic media is found to produce a substance poisonous to horses. The poisonous properties of this bacillus may be extra-cellular, or endo-cellular as a result of cell disintegration. The toxic properties of this bacillus could not be demonstrated by single injections into guinea-pigs and rabbits, using sterile cultural filtrates grown on Uschinsky's medium that proved to be pathogenic to horses. The method used to demonstrate anaphylactic phenomena in guinea-pigs with other foreign protein (egg white) failed. In this connection some anaphylactogens (bacterial) sensitise in very minute doses, while larger and repeated doses are necessary in other cases."

"Difficulty has been reported in sensitising guinea-pigs to bacterial protein. According to Rosenau and Anderson, Vaughan, Holobut, and Kraus and Doerr, a variation of technique in sensitising guinea-pigs seems more reliable than the usual methods employed in sensitising to animal proteins. The limits seem to vary with the protein and the animal. If true anaphylaxis occurred in horses Nos. 48 and 55, it is in further variation of the usual technique employed to demonstrate this phenomenon, as there existed no intervening or rest period subsequent to feeding or sensitising and the injection of the toxic dose."

"Further evidence that the filtrate immediately after filtration does not contain true protein substances are the negative chemical tests with Millon's fluid, xanthoproteic, and Heller's ring test. The uninoculated sterile Uschinsky's protein-free medium gives a positive reaction for protein by the biuret test, as does the sterile filtrate of this bacillus in Uschinsky's medium, but the latter test is not considered reliable for detecting the presence of true protein. Horses gave evidence of hyper-

subsequent to being fed with the N silage and watery extract of same to drink, and also subsequent to the feeding of O-1 cultures on bouillon, yet death followed daily injections of the sterile filtrate without preliminary treatment, suggesting the poisonous properties of the filtrate *per se*.

"Following the initial injection, manifest disturbances generally occurred in a few minutes. The sudden manifestations following injection preclude the possibility of a true soluble toxin or bacterial infection, but clearly suggest the presence of a substance which exerts a toxin-like effect. The cumulative or hypersensitive-like condition prevailing in horse No. 55 is evidence of the close relationship existing between the filtrate obtained from the bacillus isolated from the silage and the filtrate from the bacillus isolated from the oat hay, feeds responsible for widely separate outbreaks of this disease."

(205) STOCKMAN (S.). Cases of Poisoning in Cattle by Feeding on Meal from Soya Bean after Extraction of the Oil.—*Jl. Comp. Path. & Therap.* 1916. June. Vol. 29. Part 2. pp. 95-107.

This article is of interest on account of the very widespread use at present of soya bean products as feeding stuffs for cattle in all parts of the world, and on account of the often alleged cases of poisoning resulting from their use. The experiments described in this article were undertaken to ascertain the cause of deaths amongst a number of cows in the south of Scotland which had been fed on soya bean meal.

The symptoms, which were sudden in their onset, were as follows : Discharge of blood from the nostrils, congestion of the visible mucous membranes, suspension of rumination, shivering, high fever (105° to 109° F), discolouration of the faeces due to blood ; symptoms of abdominal pain ; presence of subcutaneous nodules, from the size of an egg to that of a child's head, caused by haemorrhages. The interval elapsing between the first appearance of symptoms and death in the case of the 36 animals observed varied from 1 to 17 days.

On post-mortem examination widespread haemorrhages were found on all the mucous and serous membranes of the body. In the small and large intestines these haemorrhages had caused the rupture of the mucous membrane, and appeared like the haemorrhagic ulcers sometimes seen in cattle plague and East Coast fever.

Fourteen experiments were carried out by the author with samples of the extracted soya bean cake and meal on 8 heifers, 2 pigs, 1 ewe, 3 guinea-pigs, and a rabbit. The author summarises his experiences as follows :—

"1. The cases produced at the laboratory by feeding on extracted soya cake and meal are identical in symptoms and *post-mortem* lesions with the cases occurring in the field amongst cattle which were fed on similar material.

"2. In both cases the animals were receiving other food-stuffs (some went out to grass). This discredits the possibility of the trouble being due to a deficiency in vital constituents, as in the scurvy type of disease.

"3. In both cases the trouble sometimes did not show itself for one or two weeks after the extracted soya meal or cake had been discontinued and the animal had been turned out to grass. This is a curious feature, and points to the poison being one which takes some time to act, although a poisonous dose is present in the system. It might also mean that the actual poison is manufactured inside the animal by a slow process from extracted soya (*see also 4*).

"4. The extracted soya in no case (practice or laboratory) produced a sudden effect ; in all a considerable amount was consumed, and a considerable time elapsed before signs of illness appeared. The smallest

amount consumed at the laboratory before disease began was 172 lbs. (thirty-six days); the shortest time in which disease appeared was twenty-nine days (201 lbs.).

" 5. No species other than cattle suffered from feeding on this meal or cake, either in practice or at the laboratory.

" 6. The very high temperature (106° to 109° F.) accompanying the illness seems to exclude the ordinary poisons, but does not exclude a poison of the ricin class. Specific bacterial infection was excluded by test inoculations, microscopical and bacteriological examinations, and by the fact that a sterilising temperature was used in the process of manufacture. No castor seeds could be traced in the meal.

" 7. From inquiry (very wide) whole soya bean is not poisonous.

" 8. From inquiry amongst manufacturers there is plenty of evidence that soya extracted with naphtha does not cause poisoning, and it would appear that trouble followed the use only of soya extracted with trichlorethylene.

" 9. Trichlorethylene itself, however, is not poisonous when given to cattle in comparatively large doses—1 to 3 ozs., and for long periods. It may be: (a) that the products from trichlorethylene obtained by heat are poisonous (this is doubtful); (b) that the trichlorethylene in contact with the soya and heat used to drive off the former forms a poison; or (c) that some of the trichlorethylene was impure and contained other bodies.

" 10. It would appear from what occurred in practice that all bovines are, at least, not badly affected by the poison. On nine premises upon which trouble occurred the percentage of visibly affected varied from 1 to 19 per cent.—average, 10 per cent. The farmers thought, however, that the other animals suffered also, though not visibly. It is not improbable, of course, that this was so (*see also Experiment III*), and that it was only the very badly affected which were taken as being ill. Amongst the visibly affected the death-rate varied from 6 to 100 per cent.—average, 84 per cent. It is possible, having regard to the above, that the poison is one against which a certain amount of immunity can be acquired, as in the case of ricin, but such an immunity did not show itself in Heifer 313.

" 11. If it be that, in order to obtain a poisonous quantity of the active agent, some 200 lbs., or more, of the material must be extracted, it would hardly seem to be a process which could be undertaken in an ordinary laboratory, but would require a small manufacturing plant.

" 12. If it be that the active agent is elaborated from the extracted soya in the digestive organs of bovines the problem of isolation becomes still more difficult.

" 13. If 12 be assumed, the most promising method of search might be to produce cases experimentally, and then try to extract a poison from the organs.

" 14. Extracted soya meal constitutes an excellent auxiliary foodstuff for cattle, but it is inadvisable to use trichlorethylene as the extractor."

- (206) THEILER (A.), GREEN (H. H.) & VILJOEN (P. R.). Contribution to the Study of Deficiency Disease, with Special Reference to the Lamziekte Problem in South Africa.—*Union of South Africa. Dept. of Agric., 3rd & 4th Reports of the Director of Veterinary Research.* 1915. Nov. pp. 9-68. Pretoria: Govt. Printing & Stationery Office.

The scheme of work considered in this communication comprises:—

" (a) Rice-feeding experiments upon cattle, horses, sheep, goats, and pigs, with the object of producing, if possible, deficiency disease in the animals concerned, and of comparing the symptomatology of such disease with gal-lamziekte.

" (b) Experiments with pigeons with the primary object of testing various rations used in the other experiments, in respect to their anti-neuritic efficiency or vitamine content.

"(c) Experiments on dogs with the object of inducing an avitaminosis by rice-feeding, and of testing the effect of feeding flesh of cattle which had died from lamziekte.

"(d) Feeding experiments upon cattle running on the lamziekte camps at the experimental farm, Armoedsvlakte, near Vryburg, Bechuanaland.

"In this case the object was to determine whether or not lamziekte, in its natural incidence, could be (1) controlled prophylactically by the use of supplementary rations of known high vitamine content, (2) successfully treated with vitamine extracts, (3) increased by partially substituting polished rice, known to be deficient in vitamines, for the natural pasturage, (4) influenced by factors which affected the condition of the cattle without seriously affecting the vitamine content of their diet or the extent of natural grazing.

"(e) Feeding experiments with hay cut at random from lamziekte camps, with the object of eliminating as far as possible all factors other than the purely dietetic.

"(f) An attempt to co-relate the incidence of disease with the rainfall and condition of the veld on the area concerned, in respect to hypothetical vitamine deficiency of the natural pasturage."

The results of an enormous amount of work are described which throw a good deal of light on the "vitamine" problem. The authors failed to connect the causal agent of lamziekte with any "vitamine" deficiency in the feeding stuffs. A careful perusal of this article would be of great interest to students of physiology and dietetics.

Summary and Conclusions.

"The primary economic purpose of the investigations detailed in the text was to obtain evidence for or against the hypothesis that the South African disease known as lamziekte or gal-lamziekte, a neuro-muscular fatal complaint of cattle, is an avitaminosis. Correlated to this was an attempt to produce an avitaminosis in various classes of animals and to obtain data of general interest in scientific dietetics. The evidence incidentally acquired suggesting other theories of causation, is not specifically considered.

"Pigeon-feeding tests were carried out to determine the anti-neuritic properties of various foodstuffs, more particularly those fed as supplementary rations to cattle naturally grazing over lamziekte veld suspected of vitamine-deficiency.

"On the basis of these tests, different batches of cattle on the affected area were supplied with vitamine in the form of beans, bran, maize, potatoes, and yeast, in amount in large excess of the theoretical quantity required for the metabolism of the gross food eaten. At the same time another batch was supplied with a liberal ration of polished rice with the idea of still further reducing the vitamine-content of the natural diet. The mortality in the batches receiving supplementary vitamine-rich rations and in the batch receiving polished rice, was the same as that of the control animals, and the conclusion was therefore drawn that the prevalence of lamziekte bears no relation to the vitamine-content of the natural pasturage.

"Kraaled cattle fed on hay cut at random from lamziekte areas did not contract the disease, and in so far as the limited nature of the experiment allows of a conclusion, the disease would appear to be non-dietetic (*in the nutritional sense*) in origin.

"No clear relation of rainfall to prevalence of the disease on the experimental area could be detected.

"No clear difference in mortality could be detected amongst cattle in good condition and those in poor condition. An average mortality of about 30 per cent. in the experimental cattle prevailed independently of feeding or condition.

"Therapeutic treatment with vitamine extracts, even in theoretically excessive amounts, and prophylactic treatment with yeast, proved useless.

"Cattle fed for periods up to thirteen lunar months on synthetic rations of exceedingly low vitamine-content, as judged by accepted criteria and pigeon analysis, failed to develop either lamziekte or any specific disease which could be diagnosed as an avitaminosis. This is regarded as strong corroborative evidence against the vitamine-hunger theory as applied to lamziekte, and the view is incidentally expressed that an avitaminosis in cattle is not likely to occur in practice unless manifested simply in an atrophic form clinically indistinguishable from inanition."

"Horses, fed upon diets similar to the polished rice rations fed to cattle, also developed no symptoms of specific deficiency disease within periods of six months, and the conclusion is drawn that an avitaminosis in the horse, if it exists at all, is a matter of slow development, and would tend rather to be obscured by preceding inanition, on any naturally occurring diet upon which the animal could conceivably be fed."

"Dogs fed on polished rice succumbed, after periods varying up to four months, under symptoms suggestive of generalized malnutrition rather than those of a specific clinically recognizable avitaminosis of either the beriberi or scurvy type. Specific rather than general deficiency is, however, regarded as the cause of death, although the calorific intake was not sufficiently accurately ascertainable to settle the point."

"Lamziekte biltong showed it was probably as efficient as ordinary biltong in enabling dogs to maintain equilibrium on a polished rice diet, and in restoring dogs, emaciated after rice feeding, to normal health. These experiments are regarded as analogous to pigeon tests in which no marked constant difference in vitamine content could be detected between dried flesh from healthy animals and that from diseased animals. The dogs showed no ill-effects as a result of eating the diseased biltong."

"Pigs, goats, and sheep, fed for prolonged periods on rations in which polished rice was either the exclusive or the preponderating constituent did not develop any specific deficiency disease. No definite conclusion, however, is drawn from these experiments, since the protocols are open to interpretation in more than one way."

"A number of points in connection with the problems of growth and general dietetics are raised."

THERAPEUTICS.

- (207) GREEN (H. H.). *The Sulphur Sheep Dips.—Union of South Africa. Dept of Agric., 3rd & 4th Reports of the Director of Veterinary Research.* 1915. Nov. pp. 113-162. With 3 plates comprising 13 figs. Pretoria: Govt. Printing & Stationery Office.

In this article the chemical aspect of the sulphide dips are dealt with in the following order :—

- (1) Caustic soda and sulphur dip.
- (2) Lime and sulphur dip.
- (3) Loogas and sulphur dip.
- (4) Efficacy for the cure of scab.
- (5) Probable decomposition of the sulphide dips in the fleeces of the sheep.
- (6) Effect upon the skin and wool of sheep.

The following is the author's summary :—

"1. The caustic soda and sulphur dip, as prepared according to the recommendations of the Division of Sheep, consists of a mixture of sodium pentasulphide and sodium thiosulphate with a distribution of sulphur

about four-fifths of the former and one-fifth of the latter. No monosulphide can be detected and only traces of sulphate are present. There is even the suggestion that polysulphides higher than the pentasulphide exist for a short time in the freshly prepared dip. The proportions of caustic soda and sulphur actually going into combination are approximately five to eight, and the recommended formula, 5 : 20 : 2½-100, provides so large an excess of free sulphur that complete utilization of caustic soda is ensured even under somewhat careless conditions of dip-making. The presence of free caustic soda in the dip need not therefore be feared if the instructions for dip-making are carefully carried out. The preliminary mixing of the sulphur to an homogenous cream with water is the most important step to be observed, since it is upon the intimacy of subsequent contact of the sulphur with the caustic soda solution that the reaction mainly depends. Combination takes place at comparatively low temperature, and may be completed in forty minutes at 50° C., although reaction is of course more rapid at higher temperatures. If hot water is used in the preliminary mixing, the heat evolved as the caustic soda is sprinkled in suffices to keep the mixture near the boiling point, and boiling by the application of external heat is therefore unnecessary. Boiling, however, may offer slight advantages in completing the reaction in cases where the preliminary process has been imperfectly carried out. With ordinary care a dip of correct composition always results, without boiling. If the sulphur is not properly wetted in the preliminary mixing to a cream, the bulk of the sulphur may float on the surface and cake as the caustic soda is sprinkled in, and so partially escape combination. The dip may then contain residual free alkali, but not, as might be expected, any appreciable amount of sodium monosulphide.

" 2. The lime-sulphur dip is analogous in composition to that of the caustic soda and sulphur dip, and consists of a mixture of calcium pentasulphide with calcium thiosulphate. In preparing the dip the ingredients must be boiled, and the so-called ' raw lime-sulphur dip ' consists merely of a mixture of lime and sulphur. At least two parts of sulphur to one part of unslaked lime should be used whenever a really good sample of lime is available. If other proportions are used, the material present in smaller amount determines the solution of the other, higher polysulphide rather than lower being formed in all cases. If the lime is in excess, small quantities of free hydroxide may be present in the dip, but the amount is limited by the low solubility of the lime itself. Calcium pentasulphide and calcium hydroxide can, however, co-exist in the same solution even at the boiling point.

" 3. The loogas-sulphur dip consists mainly of a mixture of carbonates, polysulphides, and thiosulphates, of sodium and potassium, the amount of polysulphide being very low and the amount of carbonate relatively high. The reaction between alkaline carbonates and free sulphur is very imperfect even after prolonged boiling, and most of the sulphur used in making the loogas dip is therefore wasted by passing into the unused sediment.

" 4. The kind of sulphur used in dip-making is of no consequence provided it is finely divided and fairly pure. Flowers of sulphur and ground rock sulphur are equally suitable, but in the latter case a guarantee of fineness of grinding should be demanded. 65° Chancel is suggested as a reasonable specification.

" 5. The quality of lime used is obviously of paramount importance in making the lime-sulphur dip, but limes generally available in the Union appear to be of very inferior grade. The saving grace in cases where bad limes have been used in practice, lies in the fact that concentrations of poly-sulphide much below that obtained in a well-made dip are still effective in curing scab.

" 6. The lime-sulphur and caustic soda and sulphur dips are reliable for the cure of scab. The loogas-sulphur dip also cured scab in the experimental trial carried out, but its composition suggests that its efficacy is largely a matter of chance, and that it is therefore not to be relied upon.

" 7. The active constituent of the sulphur dips appears to be the polysulphide, since thiosulphate, the only other important constituent is itself

ineffective. Free base, if accidentally present, does not contribute to the parasiticidal efficacy of the dips. A concentration of 0·6 per cent. sulphur in polysulphide form is probably always high enough to effect a cure. 0·3 per cent. showed itself as uncertain in action. The polysulphide content of the home-made lime-sulphur dip is much higher than that of the caustic soda and sulphur dip, but it is not advisable to dilute the home-made dip further than is already customary unless the lime used in making is known to be of very high quality. If commercial lime-sulphur concentrates are used, dilution may be conveniently carried down to a concentration of about 0·8 per cent. polysulphide sulphur.

" 8. The sulphur dips if properly made (almost neutral to phenolphthalein) are harmless both to the sheep and to the wool. Solutions of polysulphide, at the concentration used in dipping, have no action on wool even on prolonged steeping. On the fleeces of dipped sheep polysulphide is rapidly and almost quantitatively converted into thiosulphate by atmospheric oxidation, and this occurs long before the fleeces are dry. No depilatory substances are formed in detectable amount, as intermediate products in normal decomposition. If, however, free base be present in large quantity along with polysulphide it is possible for monosulphide to be formed as intermediate product in the course of atmospheric oxidation, and the possibility of depilatory action then arises. Minor quantities of free hydroxide, up to about 10 per cent. of the total base present in the dip, appear to be of no practical consequence, since they are converted into thiosulphate during atmospheric oxidation. The depilatory action of monosulphide or hydrosulphide is much more violent than that of free hydroxide.

" Under ordinary circumstances a dip would have to be very badly made indeed before the amount of residual base present could become a source of danger in practical dipping, and if reasonable care is taken in preparation the possibility of injurious action either upon the sheep themselves, or upon their wool, is altogether ruled out.

" Although dyeing or spinning tests could not be carried out at this laboratory, it appears highly improbable that the expert dealer in woollen fabrics could tell the difference between a washed fleece previously dipped in the sulphur dips and a washed fleece previously dipped in any of the ordinary proprietary dips."

(208) GREEN (H. H.). Upon the Composition and Analysis of Polysulphide Solutions.—*Union of South Africa. Dept. of Agric., 3rd & 4th Reports of the Director of Veterinary Research. 1915. Nov. pp. 173-195. Pretoria: Govt. Printing & Stationery Office.*

" 1. A general discussion of the validity of the iodine titration method of Harris for the analysis of polysulphide mixtures is offered, and preference is given to the older methods involving the use of ammoniacal zinc chloride. In the presence either of free lime or free sulphuretted hydrogen, the iodine titration method countenanced for the analysis of lime-sulphur solutions, by the American Association of Official Agricultural Chemists, is altogether invalid, but by combining the ammoniacal zinc method with simple titration to standard acid, reasonably accurate results may be obtained, whatever be the composition of the polysulphide solution.

" 2. The recent views of Ramsay and of Auld in regard to the nature of lime-sulphur solutions and to the reaction involved in their manufacture are discussed and criticized as invalid. Apart from the presence of thiosulphate, the dominant constituent is calcium pentasulphide, and 'polysulphide sulphur' is regarded as firmly combined. Even if huge excess of free lime over sulphur be used in preparation, the tendency always is towards formation of higher rather than lower polysulphides, the higher derivatives being stable even on boiling with free base.

" The possibility of the existence of derivatives above the pentasulphide is also discussed."

- (209) BEDFORD (G. A. H.). Report upon the Dipping Trials carried out with the Different Proprietary and Home-made Sheep Dips in South Africa.—*Union of South Africa. Dept. of Agric., 3rd & 4th Reports of the Director of Veterinary Research.* 1915. Nov. pp. 163-172. Pretoria : Govt. Printing & Stationery Office.

Summary and Conclusions.

" Practical trials on a small scale were carried out with the following sheep dips available in South Africa :—

" (1) Home-made Lime-sulphur Dip, (2) Capex Lime-sulphur Concentrate, (3) Modderfontein Lime-sulphur Concentrate, (4) Home-made Caustic Soda and Sulphur Dip, (5) O'Gorman's Liquid Sulphur Dip, (6) Home-made Loogas-sulphur Dip, (7) Little's Fluid Dip, (8) Hayward's Paste Dip, (9) McDougall's Powder Dip, (10) Cooper's Sheep Dipping Powder, (11) Arsenite of Soda and Sulphur Dip, (12) Jevey's Fluid, (13) Kerol, (14) Leach's Sheep Dip, (15) McDougall's Tobacco Dip, (16) Dreadnought Tobacco Dip, (17) Magic Sheep Dip, (18) Home-made Tobacco Dip.

" From six to twelve sheep, very badly infected with scab, were used in each test. In the main series of trials two dippings at an immersion period of two minutes, and a dipping interval of nine days, were carried out—the nine-day interval having been previously established as just within the life-cycle of *Psoroptes communis*, var. *ovis*, in South Africa.

" The different batches of dipped sheep were tested for eradication of scab by being kept under observation in isolation stalls for six months after dipping.

" The general results showed successful cure of scab in all trials except one. The exception is represented by O'Gorman's dip, but the failure in the case of one sheep is doubtless due to too high a dilution of the drum fluid as recommended in the directions for use. At higher tank strength this dip would also be effective.

" No attempt was made to place the various preparations in order of merit. This would have involved more extensive trials on a larger scale, and in any case it was not desired to draw invidious distinction between different proprietary articles.

" A few tests carried out at shorter immersion period and longer dipping interval indicated that, although such conditions might be effective, they could not be regarded as safe—especially in the absence of auxiliary hand-dressing, where time must be allowed for penetration of scab crust and where the danger of development of original infection is greater.

" The effect of the various dips upon the general health of the sheep, and upon the skin and wool, was not observed to be unfavourable except in the case of Leach's dip, where obvious intoxication occurred in ten out of the twelve sheep dipped. The deaths occasioned in this case are attributed to the high concentration recommended for use. At lower concentration of tank fluid and with revised instructions for use this dip would probably be efficacious and innocuous. In regard to the recent controversy concerning the home-made sulphur dips there is every indication that these, if properly used, are both effective and harmless.

" As final conclusion it may be safely asserted that, with the exceptions indicated, *all the dips tested are permissible and effective in the cure of scab if properly used at an immersion period of two minutes and a dipping interval of nine days. Single dipping or dual dipping at a longer interval than nine days, or immersion of less than two minutes, may be effective in some cases, but cannot be relied upon.*

" The tests recorded are to be regarded as experimental in nature, and as serving as basis for more extensive trial in the field. The most interesting point in the laboratory trials is the apparent ease with which scab can be cured with almost any accredited dip."

- (210) VELU. *Le traitement mercuriel chez le cheval et l'alopecie.*
[Mercurial Treatment in the Horse and Alopecia.]—*Rec. de Méd. Vét.* 1916. Apr. 30. pp. 134-136.

The author recently treated 40 horses and mules affected with epizootic lymphangitis by means of intramuscular injections of biniiodide of mercury; the doses administered ranged from 1 to 3 grammes in all for each animal, or 10 centigrammes were given every alternate day over a period of 60 days.

In no case was observed the slightest sign of hydrargyrism.

One subject only showed the classical symptoms of mercurial alopecia. This horse received the above treatment on alternate days. A month after the commencement of the treatment a considerable amount of oedema was noticed under the sternum, which extended towards the abdomen and the upper parts of the fore limbs. On the following days the usual train of symptoms exhibited by mercurial alopecia was observed, viz., an erythematous exudative dermatitis, loss of hair between the fore legs, on the shoulders, on the sides of the chest and at the base of the neck, and exfoliation of the epidermis. As the animal did not show any signs of mercurial intoxication and, in particular, no inflammation of the gums or salivation, treatment with biniiodide of mercury was continued. The animal became rapidly restored to its normal condition and at the end of the treatment was completely cured of its lymphangitis and its alopecia.

REPORTS.

- (211) CEYLON. *Administration Reports 1915. Report of Government Veterinary Surgeon.* [STURGESS, G.W.] 8pp. f'cap.

INFECTIOUS DISEASES.

Horses.—One case only of anthrax is reported.

Cattle: *Rinderpest.*—There was a considerable decrease in the number of outbreaks during the year. The numbers were as follows:—1,493 cases, number of recoveries 272, number of deaths 1,152, number shot 69. At the close of the year the island was free.

Foot-and-mouth disease.—Cases 2,366, recoveries 2,425 (including 128 cases at the end of 1914), deaths 49, balance ill at close of year 20. There was a considerable decrease compared with 1914, when 9,532 cases occurred.

Surra.—Bull treated with sodium arsenite, described in report for 1912-1913, remained in good health and no evidence of disease was shown by inoculation of its blood into a rabbit.

Tuberculosis.—This disease is rare in native cattle. A country-bred Ayrshire cow from imported parents which was suspected to be affected was tested with tuberculin. A well-marked reaction followed but no traces of tuberculosis could be found on post-mortem examination.

Anthrax and haemorrhagic septicaemia.—No serious outbreaks of these diseases occurred during the year.

Epidemic amongst swine.—An extensive outbreak of a disease resembling swine fever occurred in the Western Province, of a kind which had not previously been encountered for over 20 years.

Attention was first drawn to this disease by the condition of the carcase of a pig slaughtered at the Colombo abattoir. Its appearance pointed to a disease of the type of an acute haemorrhagic septicaemia. Evidence was obtained that this pig had been brought in from the seat of an extensive outbreak where pigs were dying in some villages by scores. Movement and sale of swine or pork were prohibited in infected villages and Inspectors were authorised to destroy suspected pigs, with the result that the outbreak rapidly subsided. The total number reported was 2,512 cases, 2,414 deaths, 1 recovery, and 97 shot.

The symptoms presented by affected pigs resembled those of acute swine fever in many respects, but the disease appeared to be of a different nature. In no case seen was cough or diarrhoea observed during life, or typical ulcerative lesions in the digestive canal or necrotic areas in the lungs, on post-mortem examination. Inoculation of a healthy young white European pig with 3 cc. of the filtrate from the blood of a dead pig gave a negative result. The disease also appeared in some respects like swine erysipelas, but in no case were the skin lesions characteristic, nor was any valvular complication of the heart noticed. Only in one instance was the heart involved, when the pericardium was found closely adherent to the heart wall.

The general symptoms were dullness, loss of appetite, constipation, catarrhal discharge from the eyes, a more or less diffuse, irregular, purple rash on the skin, and high fever, the temperature becoming subnormal during the later stages of the disease. Before death, giddiness, and tremors, of the head were common. Death usually occurred within a week. The mortality was between 90 and 100 per cent.

On post-mortem examination the lesions were not very pronounced. The heart was normal except in the case mentioned above where the pericardium was adherent. A yellow serous effusion was sometimes present in the pericardial sac. Petechiae were seen on the pleura; the lungs showed catarrhal pneumonia but were not extensively involved. A yellow serous exudate was generally present in the body cavities. The mucous membrane of the stomach was congested. The intestines showed haemorrhagic spots and ulcerative lesions. The mesentery was usually very congested. The lymphatic glands were as a rule much congested, but in some instances pale and watery. The liver was enlarged and dark in colour. Kidneys congested. Spleen normal.

At the time of the outbreak bubonic plague had appeared and was prevalent in the island. The disease did not appear to be either swine fever or swine erysipelas but an acute septicaemia or toxæmia of the nature of swine plague (*Septicaemia suum* or *Pasteurellosis suum*, *Pneumonie contagieuse du porc* in France, *Schweineseuche* in Germany.) Mr. E. BURGESS, Acting Director of the Bacteriological Institute, made a study of the disease and reference to the organism isolated by him has already been made in this *Bulletin* (Vol. 3, No. 4, Extract No. 256); a Gram-negative diplobacillus (or possibly a diplococcus) was described.

Sturgess has, however, been informed by the Medical Officer of Health, Colombo, who made a bacteriological examination of the first case reported, that bi-polar staining organisms were found in the heart blood, spleen and mesenteric glands. Mice inoculated with a trace of gland substance in sterile salt solution died within 24 hours. Broths inoculated from heart blood showed a pure culture of *Pasteurella suis*. Cultures in MacConkey's sodium taurocholate medium gave negative results using glucose, lactose, mannite and galactose, while acid reactions were given in parallel cultures with *Bacillus pestis* (human plague). The organism showed bi-polar staining with all basic stains and was Gram-negative.

[The above disease is probably identical with the so-called swine plague described on the Continent of Europe. In England this is considered to be merely one form of swine fever. Further filtration experiments would have been necessary to convince one that the outbreak was not really one of swine fever.—Ed.]

Cancerous Horn Disease of Cattle.—Several cases of this disease occurred among dairy cows during the year. The disease is believed to be of a cancerous nature, and for some reason, unexplained at present, the right horn is the one affected. The epithelioma does not develop at the outset but after the horn is shed. The first lesion takes the form of cheesy material which entirely fills the horn. The bony core is entirely obliterated. This appears to be due to bacterial processes of a necrotic nature.

The early signs are a gradual drooping of the affected horn until it is almost down to the ear level. On manipulation it is movable, hot, and somewhat swollen at the base. It is quite soft and can be severed with a knife like cheese. It is not putrid unless an opening has been formed. Commonly, a slight blow while feeding or rubbing detaches it from the skull. The whole cavity is filled with cheesy material which is easily pulled out in masses.

It is then that the serious trouble commences. From one point or another or the marginal area of the skull cavity a malignant growth appears and resists all attempts to heal it. The only chance of successful treatment is amputation in the early stages, as soon as the affected horn is observed to be on a lower level than normal. As a rule early slaughter is advisable before the animal becomes emaciated and the carcase is ruined.

Biting Flies.—Specimens of flies causing worry to cattle in the Matale district were identified as *Haematopota singallensis*.

Sarcoptic Mange in Goats.—Goats in one district were noticed to be suffering a good deal from mange, which caused emaciation and death of badly infected animals. The presence of a sarcopt was easily detected in skin scrapings. Treatment by dipping in a solution of Izal 1 oz. to 1 gallon of water, followed by the application of a mixture of kerosene, sulphur and cocoanut oil was very effective in eradicating the disease.

(212) SOUTHERN RHODESIA. Report of the Director of Agriculture for the Year 1915.—22 pp. f'cap. 1916. Salisbury: Govt. Printer.

This includes the Reports of the Chief Veterinary Surgeon (SINCLAIR, J. M.) and of the Veterinary Bacteriologist (BEVAN, Lt. E. W.).

The greater part of the report of the Chief Veterinary Surgeon is devoted to African Coast fever of cattle. The total number of fresh outbreaks and mortality compare unfavourably with previous years, due to the extensive spread of infection in two districts. On the other hand it is recorded with satisfaction that a very large part of the country is now free from this disease.

The policy adopted in dealing with these outbreaks consists in temperature observations and isolation of sick and suspected animals, together with dipping at intervals of three days. When clean veldt is available the herds are moved into it from a temperature camp. A considerable increase in the number of dipping tanks available for the use of farmers has taken place in the course of the year.

Experience points out that the following results usually occur :—
(1) Where dipping in solutions of proper strength had been regularly practised prior to an outbreak, the losses were infinitesimal ; (2) where dipping had not been practised and where tanks were not immediately available, the losses were heavy ; (3) where veldt is grossly affected to begin with, cases occur up to twelve months from the institution of regular dipping.

The existence of contagious abortion in cattle was discovered in October 1914, and since then several additional centres of infection have been discovered. The number of abortions observed in every instance was very small and Sinclair concludes that the disease is less virulent than in England because a " fair percentage of calves are born at the proper period." [He is here apparently misinformed, as the same occurs in infected herds in England.—Ed.]

Heavy losses were caused through such diseases as horse sickness, "blue tongue" in sheep, parasitic gastritis of cattle, and in young calves through white scour, etc.

Report of the Veterinary Bacteriologist.—No experimental work of interest has been performed. A vaccine for the inoculation of cattle against contagious abortion in cattle consists of an emulsion of the dead organisms. [This was proved to be useless by the Departmental Committee appointed by the Board of Agriculture in England to investigate this disease. Through producing specific agglutinins in inoculated animals, it has further the effect of vitiating the agglutinin test when applied to diagnose the existence, or the spread, of contagious abortion in a herd. The segregation of affected animals is thus rendered impracticable.—Ed.]

(213) GOLD COAST. Report of the Veterinary Department for the Year 1915. 8 pp. fcap. 1916. Accra: Government Press.

Nothing of interest, as far as tropical diseases are concerned, is contained in this report. The Veterinary Officer, Mr. W. P. B. BEAL, is being temporarily employed by the Veterinary Department of the War Office.

- (214) UNION OF SOUTH AFRICA. Department of Agriculture. The Third and Fourth Reports of the Director of Veterinary Research. November 1915.—632 pp. Pretoria: Government Printing & Stationery Office. [Price 3s. 6d.]

The results of a very large number of well-organised, expensive, and laborious investigations, undertaken by THEILER (Sir A.) and his staff, are detailed in these reports.

Most of the articles have been extracted for this Bulletin ; the others are enumerated in the lists of "Recent Literature," not because of inferior value but on account of inability to extract them at present.

Unfortunately a few of the writers in these reports show a tendency to become rather involved in their descriptions. The following passage, for example, taken from WALKER'S article on Anaplasmosis (p. 511), contains a number of inexcusable errors.

"An animal which had been previously inoculated with blood collected from a beast which was reacting to redwater, and in which redwater parasites were frequent, no apparent reaction to *P. bigeminum* ; *P. bigeminum* anaplasmosis or *P. mutans* resulting (see experiment, No. 7.) When reinoculated with blood of another immune animal containing *P. bigeminum* and *P. mutans* infections gave a temperature reaction to redwater, but no redwater parasites were seen in the smears before, during, and after the reaction. (See experiment No. 16.) *P. mutans* appeared from the 54th day."

BOOK REVIEW.

- (215) ROGERS (Thomas B.). [D.V.S.] Veterinary Handbook & Visiting List.—119 pp. Demy. 1st Edition. 1916. Philadelphia & London: J. B. Lippincott Company. [Price 6s. net.]

In his preface the author makes no claims to originality for the subject matter of his book.

The first nineteen pages contain some very elementary information on bacterial therapy and prescription writing. The great bulk of the book, pages 20 to 107, consists of an enumeration of drugs together with the doses that may be administered to the domesticated animals. The visiting list at the end does not seem to display much advantage over a plain note book.

Probably few practitioners would consider the outlay on this book economical, as similar publications, perhaps of not quite equal value, are supplied to them gratis in this country by several firms of druggists.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 4, No. 2, pp. 87-88.]

PROTOZOA.

- (216) CARINI (A.). Ueber die Hundekrankheit Nambi-Uvu und ihren Parasiten, *Rangelia vitalii*. [A Disease of Dogs, Nambi-Uvu and its Parasites, *Rangelia vitalii*.]—*Cent. f. Bakt. 1. Abt. Orig.*, 1915. Dec. 29. Vol. 77. No. 3. pp. 265-271. With 2 plates.
- (217) CARINI (A.) & MACIEL (J.). Ueber *Pneumocystis carinii*. [*Pneumocystis carinii*.]—*Cent. f. Bakt. 1. Abt. Orig.*, 1915. Sept. Vol. 77. No. 1. pp. 46-50. With 2 plates.
- (218) da CUNHA (A. M.). Sobre os ciliados intestinaes dos mamiferos II. [The Intestinal Ciliata of Mammals II.]—*Mem. do Inst. Oswaldo Cruz*, 1915. Vol. 7. No. 2. pp. 139-144. With 1 plate.
- (219) ITURBE (J.) & GONZALEZ (E.). A New Trypanosoma of the *Vampirops lineatus*.—Pamphlet from Laboratory of Dr. Juan Iturbe, Caracas, Venezuela, 1916. 7 pp. With 1 coloured plate comprising 10 figs.
- (220) JOHNS (F. M.). The Centrifuge Concentration of Malaria Plasmodia for Diagnostic Purposes.—*New Orleans Med. & Surg.* June. Vol. 68. No. 12. pp. 765-768.
- (221) KING (W. V.). Experiments on the Development of Malaria Parasites in Three American Species of Anopheles.—*Jl. Experim. Med.*, 1916. June. Vol. 23. No. 6. pp. 703-716. With 7 plates.
- (222) LIGNOS (A.). La Leishmaniose canine à Hydra. [Canine Leishmaniosis at Hydra.]—*Bull. Soc. Path. Exot.*, 1916. May. Vol. 9. No. 5. p. 302.
- (223) MAGGIO (C.) & ROSENBUSCH (F.). Studien über die Chagaskrankheit in Argentinien und die Trypanosomen der "Vinchucas" (Wanzen, *Triatoma infestans* Klug.). ["Chagas" Disease in the Argentine and the Trypanosome of "Vinchucas" (Insects, *Triatoma infestans* Klug.).]—*Cent. f. Bakt. 1. Abt. Orig.*, 1915. Sept. Vol. 77. No. 1. pp. 40-46. With 2 plates.
- (224) da MATTA (A.). Sur les leishmanioses tégumentaires. Classification générale des leishmanioses. [Tegumentary Leishmanioses. Classification of Leishmanioses.]—*Bull. Soc. Path. Exot.* 1916. July. Vol. 9. No. 7. pp. 494-503. With 2 plates comprising 12 figs.
- (225) SALVISBERG. Beitrag zur Behandlung der Coccidienerkrankung des Rindes. [Treatment of Coccidiosis in Cattle.]—*Schweiz. Arch. f. Tierheilk.*, 1916 July. Vol. 58. No. 7. pp. 369-373.
- (226) WESSELHOEFT (Conrad). i. The Early History of Malaria.—*New Orleans Med. & Surg. Jl.*, 1916. May. Vol. 68. No. 11. pp. 693-701. ii. The Discovery of the Cinchona Bark.—*Ibid.* pp. 702-714. iii. The Introduction and Early Use of Cinchona Bark.—*Ibid.* pp. 715-727.

PARASITOLOGY.

i. Helminths.

- (227) BAYLIS (H. A.). The Types of the Species *Ascaris* described by Baird.—*Parasitology*, 1916. June. Vol. 8. No. 4. pp. 411-419. With 3 text-figs.
- (228) BLANCHARD (R.). Quelques cas de pseudo-parasitisme et de xéno-parasitisme. [Some Cases of Pseudo-Parasitism and Xeno-Parasitism.]—*Bull. Soc. Path. Exot.*, 1916. July. Vol. 9. No. 7. pp. 522-541. With 2 text-figs.
- (229) BOULENGER (C. L.). Sclerostome Parasites of the Horse in England. I. The Genera *Triodontophorus* and *Oesophagodontus*.—*Parasitology*, 1916. June. Vol. 8. No. 4. pp. 420-439. With 1 plate comprising 7 figs., and 7 text-figs.
- (230) HENRY (A.) & CIUCA (M.). Nouvelles recherches expérimentales sur la cénurèse du lapin. [Further Experiments on the Coenurosis of the Rabbit.]—*Ann. Inst. Pasteur*, 1916. Apr. Vol. 30. No. 4. pp. 163-179.
- (231) MEGGITT (F. J.). A Contribution to the Knowledge of the Tapeworms of Fowls and Sparrows.—*Parasitology*, 1916. June. Vol. 8. No. 4. pp. 390-410. With 3 plates comprising 23 figs., and 1 text-fig.
- (232) MEGGITT (F. J.). A Tri-Radiate Tapeworm (*Anoplocephala perfoliata* Goeze) from the Horse.—*Parasitology*, 1916. June. Vol. 8. No. 4. pp. 379-388. With 1 plate comprising 8 figs., and 2 text-figs.
- (233) RAILLET. La famille des Thelaziidae. [The Thelaziidae Family.]—*Jl. Parasit.*, 1916. Mar. Vol. 2. No. 3. pp. 99-105.
- (234) RAILLET. La resistance des trichines au froid. [Resistance of Trichinae to Cold.]—*Rec. de Méd. Vét.*, 1916. Jan. 15-Feb. 15. Vol. 92. Nos. 1 & 2. pp. 32-34.
- (235) RAILLET (A.) & HENRY (A.). Les Filaires des Rapaces [Falconiformes et Strigiformes]. [Filaria of Birds of Prey.]—*Bull. Soc. Path. Exot.*, 1916. June. Vol. 9. No. 6. pp. 364-369.
- (236) THEILER (A.) & ROBERTSON (W.). Investigations into the Life-History of the Wire-Worm in Ostriches.—*Union of South Africa, Dept. of Agric. 3rd & 4th Reps. of the Director of Vet. Res.*, 1915. Nov. pp. 291-346. With 9 plates comprising 22 figs.
- (237) WARD. Gongylonema in the Role of a Human Parasite.—*Jl. Parasit.*, 1916. Mar. Vol. 2. No. 3. pp. 119-125. With 1 plate comprising 2 figs.
- (238) YOSHIDA (Sadao). On the Intermediate Hosts of the Lung Distome, *P. westermani*, Kerbert.—*Jl. Parasit.*, 1916. Mar. Vol. 2. No. 9. pp. 111-117. With 1 plate comprising 6 figs.

ii. Arthropods (Acarai, Flies, Ticks).

- (239) BEDFORD (G. A. H.). Experiments and Observations carried out with *Psoroptes communis* at Onderstepoort.—*Union of South Africa, Dept. of Agric. 3rd & 4th Reps. of the Director of Vet. Res.*, 1915. Nov. pp. 99-112. With 6 text-figs. & 2 plates.

- (240) GRAHAM-SMITH (G. S.). Observations on the Habits and Parasites of Common Flies.—*Parasitology*, 1916. June. Vol. 8. No. 4. pp. 440-544. With 8 plates, 17 text-figs. & 9 charts.
- (241) HERMS (W. B.). The Pajaroello Tick (*Ornithodoros coriacus* Koch). With Special Reference to Life History and Biting Habits.—*Jl. Parasit.*, 1916. Mar. Vol. 2. No. 3. pp. 137-142. With 1 fig.
- (242) LANGERON (M.). Remarques sur les larves du *Culex geniculatus* et sur les larves de Culicinés pourvues d'un long siphon. [Larvae of *Culex geniculatus*, and of Culicines provided with a Long Siphon.]—*Bull. Soc. Path. Exot.*, 1916. July. Vol. 9. No. 7. pp. 438-442. With 7 text-figs.
- (243) LUTZ (A.), NEIVA (A.) & LIMA (A. C.). Sobre "Pupipara" ou "Hipposcidae" de aves brasileiras. [The "Pupipara" and "Hipposcidae" of Birds in Brazil.]—*Mem. Inst. Oswaldo Cruz*, 1915. Vol. 7. No. 2. pp. 173-197. With 2 plates.
- (244) WALKER (J.). A Short Note on the Occurrence of *Cytodites nudus* (Vizioli) in the Domestic Fowl in South Africa.—*Union of South Africa. Dept. of Agric. 3rd & 4th Reps. of the Director of Vet. Res.*, 1915. Nov. pp. 575-582. With 1 plate comprising 3 figs.

BACTERIA, ULTRAVISIBLE VIRUSES, etc.

- (245) BULL (C. C. G.). Further Observations on the Agglutination of Bacteria *in vivo*.—*Jl. Experim. Med.*, 1916. July 1. Vol. 24. No. 1. pp. 25-34. With 1 plate comprising 5 figs.
- (246) FISCHER (J.). Untersuchungen über die Darmflora beim gesunden Ochsen. [The Intestinal Flora in Healthy Cattle.]—*Cent. f. Bakt. 1. Abt. Orig.*, 1915. Sept. Vol. 77. No. 1. pp. 6-39.
- (247) GOOD (E. S.) & CORBETT (L. S.). A Study of Gas-Production by Different Strains of *Bacillus abortivo-equinus*.—*Jl. Infect. Dis.*, 1916. June. Vol. 18. No. 6. pp. 586-595.
- (248) MELLO (Ugo). Observations et considérations sur une vaste enzootie de blépharo-conjonctivite chez le cheval. [A Wide-spread Enzootie of Blepharo-Conjunctivitis in the Horse.]—*Nuovo Ercol.*, 1914. Dec. Nov. 20-Dec. 20. (Extracted in *Rev. Gén. de Méd. Vét.*, 1916. June. Vol. 25. No. 294. pp. 267-268.)
- (249) MITCHELL (D. T.). Investigations into Jagziekte or Chronic Catarrhal-Pneumonia of Sheep.—*Union of South Africa. Dept. of Agric., 3rd & 4th Reps. of the Director of Vet. Res.*, 1915. Nov. pp. 585-614. With 2 plates comprising 8 figs.
- (250) MORI (Nello). Studio su di una epizoozia di Vaio manifestata nei bufali e negli equini della Piana di Salerno, con vari casi di trasmissione all'uomo. [An Outbreak of Variola among Wild Oxen and Horses in the Piana di Salerno with Some Cases of Transmission of the Disease to Man.]—*Giorn. Med. Vét.*, 1916. June 24 and July 1. Vol. 65. Nos. 26 & 27. pp. 577-588 & 604-613.
- (251) PORCHEER (C.) & GODARD (P.). Le lait et la fièvre méditerranéenne. [Milk and Malta Fever.]—*Bull. Soc. Path. Exot.*, 1916. May. Vol. 9. No. 5. pp. 285-286.

MISCELLANEOUS.

- (252) de BERGEVIN (E.) & SERGENT (Et.). A propos de l'hypothèse de la transmission du goitre endémique par un insecte piqueur. [The Theory of the Transmission of Endemic Goitre by a Biting Insect.]—*Bull. Soc. Path. Exot.*, 1916. June. Vol. 9. No. 6. pp. 345.
- (253) DON (G.). Report on *Acokanthera venenata*, G. Don, from the Transvaal.—*Union of South Africa. Dept. of Agric. 3rd & 4th Reps. of the Director of Vet. Res.*, 1915. Nov. pp. 617-623. With 5 text-figs.
- (254) GREEN (H. H.). Arsenical Dip-Tester.—*Union of South Africa. Dept. Agric. 3rd & 4th Reps. of the Director of Vet. Res.*, 1915. Nov. pp. 197-214. With 5 text-figs.
- (255) PHISALIX (Mme. M.) & CAIUS (R. P. F.). Propriétés venimeuses de la salive parotidienne chez des Colubridés aglyphes des genres *Tropidonotus* Kuhl, *Zamensis* et *Helicops* Wagler. [Venomous Properties of the Parotid Saliva in the Non-poisonous Colubrines.]—*Bull. Soc. Path. Exot.*, 1916. June. Vol. 9. No. 6. pp. 369-375.
- (256) RAVAUT (P.) & KROLUNITZKY (G.). L'emploi du novarsénobenzol dans le traitement de la dysenterie amibienne. [Novarseno-benzol in the Treatment of Amoebic Dysentery.]—*Bull. Soc. Path. Exot.*, 1916. July. Vol. 9. No. 7. pp. 510-522.
- (257) ROGERS (F. T.). The Hunger Mechanism in Birds (Preliminary Report).—*Proc. Soc. Experim. Biol. & Med.*, 1916. Mar. 15. Vol. 13. No. 6. pp. 119-121.
- (258) TAYLOR (Kenneth). Studies on the Blood of the Albino Rat. The Normal Cellular Constituents. Their Reaction to Sarcoma Growth and to Benzol Treatment.—*Proc. Soc. Experim. Biol. & Med.*, 1916. Apr. 18. Vol. 13. No. 7. pp. 131-134.
- (259) VIALLATE (Ch.). Rapport sur le fonctionnement du laboratoire de microscopie de Beni-Abbès (Sahara Oranais) en 1915. (Note III le "Debab," IV. Sur les embryons de filaire dans le sang du cheval. V. Sur une Myiasis cavitaire du dromadaire). [Report on the Work of the Laboratory of Microscopy of Beni-Abbès (Sahara Oranois) in 1915. III. "Debab." IV. Filarian Embryos in the Blood of the Horse. V. Cavitary Myiasis of the Dromedary.]—*Bull. Soc. Path. Exot.*, 1916. July. Vol. 9. No. 7. pp. 469-486.

TROPICAL DISEASES BUREAU.

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[No. 4.

PROTOZOOLOGY.

(a) COCCIDIOSIS.

- (260) BATES (L. B.). Coccidiosis of Calf.—*Proc. Med. Assoc. Isthmian Canal Zone.* 1915. Apr. to Dec. Vol. 8. Pts. 1 & 2. pp. 92-94.

In this short note the author describes a case of coccidiosis in a calf kept for experimental purposes at the Board of Health Laboratory, the Panama Canal.

Outbreaks of coccidiosis had appeared very frequently among rabbits kept at the laboratory, sometimes even killing off the entire supply. The calf in question had been placed for a few days in a field in which the rabbit hutches were situated. On the sixth day after returning to its shed the calf commenced to pass small quantities of blood with its faeces ; on the next day the amount of blood increased, and on the third day the excreta consisted almost entirely of blood, some of the clots being as large as a fist. The discharges had an extremely foul odour. The blood ceased on the fifth day but the diarrhoea continued for several days longer, the discharge consisting of mucus with the same foul odour. Throughout the attack the calf retained its appetite, but it lost weight rapidly. The animal was then disposed of and no further examination was made.

Bacteriological examination of the faeces as to the presence of human bacillary dysentery proved negative. On the third day of the disease the faeces were examined under a low power of the microscope and about 20 coccidia were found per field. These averaged about 60μ long by 40μ in width.

- (261) CREMONA (P.). Contributo allo studio della coccidiosi degli uccelli. [Avian Coccidiosis.]—*Nuovo Ercolani.* 1916. Oct. 10-20. Vol. 21. Nos. 28-29. pp. 472-474.

In this short article the author describes the occurrence of intestinal coccidiosis in the sea swallow (*Sterna hirundo*) and in the seagull (*Larus ridibundus*).

Extreme emaciation and diarrhoea before death were noted in both cases. The parasite from the sea swallow is stated to have been oval or elliptical in shape, measuring from 25-35 microns long by 15-20 broad. Otherwise no study of the parasites seems to have been made.

(b) BIRD MALARIA.

- (262) DE MELLO (F.) & BRAZ DE SA (L. J.). A Contribution to the Study of Haemoprotezoa in Portuguese India.—*Indian Jl. Med. Res.* 1916. Apr. Vol. 3. No. 4. pp. 731-737. With 1 coloured plate comprising 42 figs.

(1) *Schizogonic Cycle* of *Haemoproteus Columbae*.—The authors confirm the findings of the SERGENT brothers that the halteridium of the pigeon has no flagellate phase in its developmental cycle. Pure haemoproteus infection without accompanying trypanosomes was noted. Their work confirms the descriptions given by ACTON and KNOWLES [see this *Bulletin*, Vol. 2, No. 4. Extract No. 343] with the following exceptions:—Forms with chromatin fission were found not only in the lungs but also in the heart blood. The chromatin division was not a regular binary process and the nuclear masses formed became transformed into chromidial dust as they were produced. Circular forms with centrally placed nucleus surrounded by chromidial dust were not observed. The name *Acton body* is given to the free schizogonous form in the plasma and *merozoblast* to the later stage which gives origin directly to the merozoites and contains no nucleus but only idiochromidia.

(2) *Haemoproteus moruony* N.S.P.—This parasite was discovered in the blood of a common singing bird, the "madwana" or "moruony," *Copsychus saularis* (Linn.). The general features of this parasite resembled those of *H. columbae*, but with the important difference that all stages of its development were seen in the blood and no special forms were found in the internal organs.

(3) Note on a *Plasmodium* found in Bats.—A list of the species of *Plasmodium* hitherto found in bats is given. Two out of 11 specimens of *Vespertilio muricola* were found infected with the parasites of bat malaria and the schizogonic cycle is illustrated in the plate. The following points are noted in connection with the parasite:—(1) Bacillary forms of the young parasite occur; (2) precocious division of the chromatin; (3) constancy of six merozoites in the rosette; (4) circular or ovoid-shaped gametocytes. The name *P. mackiei* is proposed for this parasite. The bats were infected with ectoparasites of the family *Nycterobiidae*. Nothing is known of the sporogony.

(c) HERPETOMONIASIS.

- (263) FANTHAM (H. B.) & PORTER (Annie). The Significance of Certain Natural Flagellates of Insects in the Evolution of Disease in Vertebrates.—*Jl. Parasit.* 1916. June. Vol. 2. No. 4. pp. 149-166. With 1 table & 2 figs.

In this paper the authors summarise the results of experiments which have been conducted by them for a number of years in order to ascertain whether certain of the parasitic Mastigophora, notably members of the genera *Herpetomonas* (or Leishmania-like bodies) and *Crithidia* (or bodies such as the forms which some trypanosomes assume in their development in the bodies of insects or in culture), when introduced into the bodies of vertebrates by ingestion of infected insects or by way of wounds or abrasions of the skin, exert pathogenic effects on the host.

The flagellates used in these experiments comprise *Herpetomonas jaculum* Léger, parasitic in the gut of the Hemipteran, *Nepa cinerea*; *H. stratiomyiae* Fantham and Porter, from the intestine of the Dipteran, *Stratiomyia chameleon*; *H. pediculi* Fantham, from the alimentary tract of *Pediculus vestimenti*; *H. culicis* Novy and MacNeal, from the larvae and adults of the gnat, *Culex pipiens*; and *Crithidia gerridis* Patton, parasitic normally in the alimentary tract of the Hemipteran, *Gerris paludum*.

The vertebrate hosts included representatives of the Pisces (stickleback, *Gasterosteus aculeatus*); Amphibia (frog, *Rana temporaria*, toad, *Bufo vulgaris*, and newt, *Molge vulgaris*); Reptilia (lizard, *Lacerta vivipara*, and grass snake, *Tropidonotus natrix*); Aves (canary, *Serinus canarius*, sparrow, *Passer domesticus*, and martin, *Chelidon urbica*); and Mammalia, (dog, *Canis familiaris*, and mouse, *Mus musculus*).

The insect flagellates were introduced into their respective vertebrate hosts either by inoculation or feeding. Blood films were made periodically during the life of the infected animals and smears of the internal organs at autopsy.

The results of these experiments are best given in the following summary of the authors:—

"(1) Herpetomoniasis can be induced in various warm and cold-blooded vertebrates when the latter are inoculated or fed with herpetomonads occurring in the digestive tracts of various insects. The infection produced and the protozoal parasites found in the vertebrates resemble those of human and canine leishmaniases.

"(2) An infection can also be induced in certain vertebrates when they are fed or inoculated with *Crithidia gerridis*, and both flagellate and non-flagellate stages occur therein, but no transition to a trypanosome was found.

"(3) The following Flagellata have been proved pathogenic to warm-blooded vertebrates when the latter have been fed, or inoculated subcutaneously or intraperitoneally with them—*Herpetomonas jaculum*, *H. stratiomyiae*, *H. pediculi*, *H. ctenocephali*, *H. culicis*, and *Crithidia gerridis*. The hosts used were mice of various ages, dogs, canaries, sparrows and martins.

"(4) *Herpetomonas jaculum* and *Crithidia gerridis* have also been successfully fed or inoculated into cold-blooded hosts, namely, fishes (*Gasterosteus aculeatus*), frogs, toads, lizards (*Lacerta vivipara*) and grass-snakes (*Tropidonotus natrix*).

"(5) The disease induced may run an acute or a chronic course. In the acute cases among our vertebrates the flagellate form of the parasite was the more obvious at death. In chronic cases, non-flagellate forms of the parasite were more numerous.

"(6) Natural herpetomoniasis of a pigeon has been recorded by Drs. Edm. and Et. Sergent in Algeria. This affords a parallel case with the natural and induced herpetomoniasis of mice as recorded by us.

"(7) The flagellate stage of *Leishmania donovani* in vertebrates is now known, and that of *L. tropica* in man has been known for some time. The links completing the evidence that a Leishmania is morphologically a Herpetomonas are thus complete. We believe that leishmaniases are invertebrate-borne herpetomoniases, and that these maladies have been evolved from flagellates of invertebrates (especially herpetomonads of insects), which have been able to adapt themselves to life in vertebrates.

"(8) In areas where leishmaniases are endemic an examination should be made of all insects and other invertebrates likely to come into contact with men or dogs or domestic vermin like rats and mice, in order to ascertain if these invertebrates harbour herpetomonads. Preventive measures should be directed against such invertebrates, especially arthropods. Further, it is likely that members of all classes of vertebrates, and

especially those members that are insectivorous, may serve as reservoirs for leishmaniases, or as they should preferably be termed, herpetomoniases. The virus may exist in such reservoirs in a very attenuated condition and so be difficult of detection. From these sources the herpetomonads may reach man by the agency of ectoparasites or flies, especially such as are sanguivorous."

(d) SARCOSPORIDIOSIS.

- (264) CRAWLEY (H.). *The Sexual Evolution of Sarcocystis muris.*—
Proc. Acad. Nat. Sci. Philadelphia. 1916. Jan. pp. 2-43. With
 4 plates comprising 93 figs.

For the investigations described in this paper mice were fed with the muscles of mice infected with Sarcosporidia, and killed at intervals varying from 1 up to 24 hours. The entire alimentary canal was then removed and placed in an appropriate fixing solution (Hermann's fluid, picro-acetic acid, or alcoholic-corrosive-acetic mixture).

After fixation the small intestine was cut up into 25 to 30 pieces which were numbered, and selected pieces were then embedded in paraffin and sections cut. The best staining results were obtained with iron haematoxylin.

Exfoliation of the intestinal epithelium, as first signalised by ERDMANN (1910), was noted to occur in varying degrees.

The evolution of the Sarcosporidia within the epithelial cells of the small intestine is depicted semi-diagrammatically in the series of figures accompanying the article, the greater part of which is devoted to a description of the evolution of the parasites as depicted in these figures. The rapid differentiation and evolution of the sarcocysts is best described in the author's own summary, which is as follows:—

"(1) The spores of *Sarcocystis muris*, ingested by a mouse, may reach the posterior part of the small intestine within one hour.

"(2) Invasion of the epithelium cells of the intestine may also take place within the same time.

"(3) Upon reaching the lumen of the intestine, the spore rapidly undergoes changes. The nucleus becomes larger and more conspicuous, and a distinct nuclear net becomes evident. The granules characteristic of the spore as it occurs in the cyst either disappear or become much less evident. Further changes, however, do not take place unless the spore gains an intracellular situation.

"(4) The spores are sexually differentiated, but it does not appear to be possible, at the outset, to distinguish between the males and females.

"(5) Within the mouse cells the changes undergone by the males, or microgametocytes, begin to be evident at the end of 1½ to 2 hours.

"(6) These changes are, first, a further increase in the size of the nucleus accompanied by a further development of the nuclear net, and, second, degeneration and ultimate disappearance of the cytoplasm. The cell contours become rough and irregular, vacuolization occurs, the cytoplasm becomes reduced to two masses of debris lying at the ends of the nucleus. These finally disappear, the entire process usually being completed at the end of six hours. The microgametocyte is thus reduced to its original nucleus, which, however, is of approximately the same size as the original spore.

"(7) Conspicuous internal changes next take place, which modify both the morphology and chemistry of the parasite. They may be considered under three headings, but they all take place more or less simultaneously."

"(a) The chromatin appears to suffer a loss in actual bulk, but alters in staining reaction from acidophil to basophil.

"(b) From occurring in large irregular masses or distributed along the threads of the lining net in strips or bands, the chromatin is

reduced to granules which become progressively smaller and smaller and at the same time display a greater and greater affinity for chromatin stains.

"(c) These granules finally assemble in clusters around the periphery of the organism.

"(8) The next step is the solidification of these granular clusters into rounded, solid balls. These balls next elongate and become minute, thread-like bodies, which are the microgametes. This stage may be found in mice killed from 9 to 18 hours after inoculation. It is very rare in the shorter of these two periods, but has apparently passed its acme at the end of 18 hours.

"(9) The females go through with their development side by side with the males, but there are no such conspicuous changes and the early female stages are much like the spore which has just entered the cell.

"(10) In the course of a few hours, however, the females can be picked out, appearing as broadly oval cells, relatively shorter and broader than the original spores. The cytoplasm is all retained and assumes a rather dense alveolar texture. The nucleus shows no evident increase in size. The nuclear net does not develop as it does in the male parasite, but the chromatin concentrates into a single large karyosome which maintains an acidophil rather than a basophil staining reaction.

"(11) In the 6- to 15-hour periods, phenomena are seen which seem best interpreted by regarding them as maturation. Irregular chromatin granules appear in close association with the nuclear membrane. Later these granules pass out into the cytoplasm, and finally disappear.

"(12) The mature female, or macrogamete, may be found in mice killed from 11 to 18 hours after inoculation.

"(13) Finally, in the 18-hour stages, macrogametes may be found which in some cases show minute, thread-like bodies upon their surfaces, and in others contain within their substances small solid chromatic bodies, one in each case. These appearances are regarded as warranting the interpretation that fertilization takes place."

(265) CRAWLEY (H.). The Zoological Position of the Sarcosporidia.—
Proc. Acad. Nat. Sci. Philadelphia. 1916. June. pp. 379-388.

In this paper the author describes certain phenomena which have been observed to occur in the course of the evolution of the Sarcosporidia, suggesting that they are in many respects very nearly related to the Coccidia.

Following DORFLIN's (1911) classification of the Protozoa the Sarcosporidia are thus grouped as a sub-order of the order Coccidiomorpha (sub-class Telosporidia, class Sporozoa), and not among the Neosporidia as has been hitherto customary to classify them.

The following is the evidence on which the author bases his theory :—

FANTHAM (1913) in the case of *Sarcocystis colli* speaks of two kinds of spores.

The author himself in the case of *Sarcocystis muris* (see above Extract, No. 264) showed that the spores are differentiated into males and females which quickly develop along their respective lines within the intestinal cells of the mouse; fertilisation takes place but no stage was observed beyond the fertilised zygote.

ERDMANN (1914) describes multiplication stages of a parasitic protozoan in the intestinal cells and tissues of mice killed some days after ingestion of spores. These are apparently derived from the zygotes. About the 45th day the parasite appears in the muscles.

NÈGRIE (1907), and recently, the author himself have demonstrated that the faeces of infected mice are capable of infecting a clean mouse on ingestion.

The history of the muscle stages is obscure.

NEGRI (1910) found, in a rat killed 50 days after feeding, the smallest and youngest stage to be about 25 microns long. These bodies, which he termed sporoblasts, divided repeatedly until the cyst became formed.

BERTRAM (1892) describes similar stages in the evolution of *S. tenella* in the muscles of the sheep.

The author himself recently discovered single bodies and groups of 2 and 8 sporoblasts in the case of *S. tenella* in the heart of the sheep, thus furnishing direct evidence that the sarcosporidian cyst originates from a single cell.

The life-history of *Sarcocystis muris* may thus be divided into three portions, viz., (1) sexual development which takes place in the intestinal epithelium, (2) the obscure stage which follows, in which it is conceivable that it is the encysted zygote that infects the faeces, and (3) the stage which occurs in the muscles.

The sarcosporidian "spore" is assumed to be the homologue of the coccidiomorphan merozoite, the sexual stages of both being alike. The multiplication products of the sarcosporidian zygote are supposed to be the homologues of either the spores or sporozoites of the Coccidiomorpha. The sporoblast is not so easy to place. It may correspond to either the sporozoites or the trophozoites of the Coccidiomorpha. A knowledge of its derivation is necessary before this point can be determined. The sarcosporidian muscle stage seems to be homologous with the entire schizogonous cycle of the Coccidiomorpha.

To account for the widespread occurrence of Sarcosporidia in purely herbivorous animals, such as sheep, the author suggests that a second host, a carnivorous animal, infects itself by eating the infected flesh of the former; the merozoites subsequently released in the intestine initiate the sexual cycle, and the encysted form is then discharged in the faeces. In the case of omnivorous animals, such as mice, the existence of a second host would appear to be unnecessary.

(e) PIROPLASMOSES.

- (266) BIMBI (P.). La Piroplasmosi equina in Sardegna. [Equine Piroplasmose in Sardinia.]—*Moderno Zooiatro. Parte Sci.* 1916. Sept. 30. Vol. 5. No. 9. pp. 225–233.

This article is concerned with a clinical study of equine piroplasmose in Sardinia. The disease was discovered for the first time in the island by BARUCCHELLO and PRICOLO in 1908. It exists in an enzootic state throughout the island, especially in the provinces of Cagliari and Sassari, the one a flat marshy district containing numerous ticks, and the other at a much higher altitude.

The author refers to the studies of NUTTALL and STRICKLAND (1912), and of CARPANO (1913) in Italy. These authors demonstrated that the disease may be produced by two distinct intra-corporeal parasites, viz., the *Nuttallia equi* and *Babesia caballi*, of which the former appears to be the most widespread.

Bimbi maintains that the disease in Sardinia, according to its clinical manifestations, is without exception a babesiosis.

CARPANO showed that the transmitting ticks in Italy were the *Rhipicephalus bursa* in the case of *N. equi*, and *Margaropus annulatus* in the case of *B. caballi*. The author believes that the latter tick is the sole transmitter in Sardinia.

The disease is seasonal in distribution and cases occur during the hotter part of the year, i.e. from May to September. Nuttalliasis on the other hand, according to CARPANO, breaks out during the colder part of the year.

Native Sardinian horses appear to possess a high degree of immunity; at least clinical cases are never seen. All the cases of piroplasmosis observed occurred among imported horses, viz., Hungarian horses belonging to the various posts of mounted police (*carabinieri*). Cases nearly always occur singly.

The disease invariably runs an acute or sub-acute course, characterised by high fever—up to 40·9° C.—lasting from five to eight days, after which the temperature falls to nearly normal. Other symptoms are marked icterus and nervous prostration, which, however, is never so serious as in the case of nuttalliasis, where paresis or even paralysis of the hind quarters may occur. Petechiae sometimes occur. The urine is slightly more highly coloured than normal, but it is never blood-tinged as in the case of nuttalliasis. Following on these acute symptoms the disease runs a benign course and always ends in the recovery of the affected animal. Chronic forms as in nuttalliasis are not seen.

Quinine has given very good results in the treatment of the disease when administered in repeated small doses. Accordingly, about 2·5 grammes of quinine hydrochloride dissolved in 10 cc. of sterile distilled water are injected subcutaneously two or three times a day for three or four days in succession and then once every two or three days. The drug is apparently very beneficial in shortening the convalescent period.

On account of the blood destruction and anaemia produced by the disease convalescence is long, the anaemia lasting from 24 to 30 days, and hence the author recommends a long period of rest during which good nursing should be applied, accompanied by the administration of drugs such as cacodylate of soda and strychnine.

(267) MARKOFF (W. N.). *Piroplasmose und andere blutparasitäre Krankheiten der Haustiere am Balkan.* [Piroplasmosis and Other Diseases of Domesticated Animals due to Blood Parasites in the Balkans.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1916. July. Vol. 20. No. 14. pp. 313-335.

The author's observations were made for the most part during the first Balkan Wars in 1912-1913 and during the year 1914 in the various places occupied by the Bulgarian Army.

Equine Piroplasmosis.

The author first gives an account of the distribution of the disease in the Balkan Peninsula and from these facts he concludes that the disease originally came from Southern Russia and spread down along the coast of the Black Sea over the Danube. It then reached the

Dubrudja and later spread from the Black Sea coast towards Bulgaria and further south towards the Strandja Mountains into Turkey until it came to Tschataldja. From this place it apparently spread over the Bosphorus into Armenia, Persia, and then towards the Caucasus until it came back again into Southern Russia.

A short description is then given of the reported occurrence of the disease in various parts of the world by different authors, together with the transmitting ticks.

In the Balkans the only transmitting tick seen was the *Dermacentor reticulatus*, which is also the vector in Southern Russia, and it was observed that as soon as horses became covered with these ticks cases of piroplasmosis occurred.

The causal agent appears to be of the type *Piroplasma bigeminum*. At first no parasites could be seen in blood smears although the horses showed unmistakable symptoms of piroplasmosis. As in BILITZER's observations (1906) in Southern Russia, it was thought that the disease was equine influenza. On further examination the parasites were found in the blood of several horses; in one case as many as nine could be seen in among 26 red corpuscles in a field of the microscope. Several parasites could be seen laying free in the plasma. No organisms of the *Parvus* type were ever observed, i.e., forms in which the elements are arranged in the form of a cross. The majority were pear-shaped or conical, sometimes long-shaped elliptical, ring-shaped prismatic, and seldom spindle-shaped. In the case of the pear-shaped parasites growth was often seen to take place from the points and from the broad ends, in the latter case then reminding one of a figure 8. The bodies lying free in the plasma had exactly the same form and appearance as the intracorporeal elements. The chromatin was very varied in form, size, quantity, and arrangement. It was very often seen free in the plasma and collected into masses. The parasites attained from one-third to one-eighth the size of the red corpuscles and lay in different parts of the corpuscles.

In the case of two horses piroplasma-like structures destitute of chromatin were seen in the blood, for the most part free in the plasma. The margins stained rather intensely. The blood corpuscles in the case of these animals showed no changes except that there was apparently a marked leucocytosis. These animals had developed a temperature of about 1° C. above normal, which lasted from two to three days and then disappeared. The bodies were not then seen in the blood. The peculiar structure of the organisms was probably due to the individual resistance of the animals.

Clinically, the disease was observed to be for the most part acute, seldom chronic, and in one case relapsing. The temperature at first rises 2° or 3° C. above normal and this febrile period lasts only a few days and the temperature then falls. During the febrile period other symptoms appeared such as general weakness, uncertain gait, and icterus of the visible mucous membranes, which are usually of a saffron-yellow colour. The icterus lasts from about 7 to 13 days, but in rare cases it may be absent. In severe cases petechiae appear. The pulse is weak and irregular and the respiration weak and accelerated, except in the case of lung complications.

At Tschataldja following on a severe winter in which the horses suffered from scarcity of food the author noticed in later months

(April, May, and June) complications in the form of subcutaneous swellings accompanying the disease. These were about the size of an egg to start with, but later reached a length of 50 to 60 cm. or more at their greatest diameter. As a rule they affected the breast and the sheath but sometimes the neck, chest, and the head. They were cold, painless, and firm in consistence and lasted from about a week up to one or two months in some cases. Abscess formation did not take place.

The alimentary tract was not affected. The nervous system during the febrile period is somewhat dulled and the animal often exhibits a somewhat uncertain gait. Change in the colour of the urine was only observed in two cases and in these it was only chestnut-brown, not red. The blood was pale and watery looking.

According to the author's observations the disease lasts without complications from seven to eight days up to three weeks, and terminates favourably. In cases where the disease is not observed and the animals worked complications are often seen in the lungs and other organs. The mortality ranges between 5 and 12 per cent.

On post-mortem examination the following changes are found: general anaemia accompanied by icterus; in the peritoneal cavity about a litre of serous exudate; liver yellowish and slightly enlarged, friable; spleen greatly enlarged, soft in consistence, and intensely congested on section; kidneys likewise show degenerative changes together with infiltration under the capsule. Stomach and intestines often show a diffuse inflammation. The thoracic organs are congested; there is a serous exudate in the pericardial sac. The blood corpuscles show the usual anaemic changes.

The author then gives a history of the outbreaks he has dealt with.

The disease has to be differentiated from various poisonings, anthrax, equine influenza, and purpura haemorrhagica.

The various methods of immunisation devised by THEILER, CARPANO, and BILITZER, respectively, are enumerated.

With regard to treatment two or three injections of trypanblue are recommended in severe cases. Otherwise medicines should be avoided.

Bovine Piroplasmosis.

This disease, commonly known as "Krtschan," has been known in Bulgaria since the earliest times; its etiology was first discovered in the country by TATSCHEFF (1893). It is found in every part of the country and during the Balkan war was seen by the author in Thrace, Macedonia, Turkey, etc. The disease is transmitted not only by *Ixodes ricinus* but by several other, unknown, ticks.

Two types of parasites are seen in the blood. The majority appear to be of the type *Babesia bovis* whilst the others, according to their size, resemble *B. bigeminum*. These differences have been described by KNUTH. BOIKINOFF found that the blood parasites of cattle affected with redwater in the mountains seemed to be much smaller in size than other known cattle piroplasms.

The disease may be acute or chronic and the symptoms correspond with those of redwater in other countries.

Reference is made to a redwater of cattle discovered by ANGELOFF in the Rhodope mountains. This resembled the disease known as

"Stallrot" in Germany, Belgium and France. No piroplasm was found in the blood which, however, showed marked anaemic changes including especially the presence of basophile granules in the red corpuscles.

Piroplasmosis of Sheep.

This also is known under the name of "Krtschan" or "May disease." It appears in the late spring and occurs in all parts of the Balkan Peninsula, causing great loss. Sheep imported from Russia for cross-breeding purposes always succumb.

Dourine.

A few cases were introduced into the country in horses imported for breeding purposes. The disease has now been stamped out. In the neighbouring countries, Serbia, Turkey, and Greece, the disease has always been unknown.

The author gives a description of the symptoms observed and the difficulty in finding the parasite in the blood and excretions.

Fowl Spirochaetosis.

This disease has been observed by the author and described by others in Bulgaria; it occurs in Roumania, and apparently also in Serbia and Turkey. The transmitting tick is *Argas persicus*.

Successful results were obtained by treating infected fowls with the blood of an ass immunised with blood containing spirochaetes. The successful treatment of spirochaetosis by means of normal heterologous sera has already been described by the author.

(f) TOXOPLASMOSIS.

- (268) PLIMMER (H. G.). Notes on the Genus *Toxoplasma*, with a Description of Three New Species.—*Proc. Roy. Soc.* 1916. Aug. 1. Series B, Vol. 89. No. B 616. pp. 291–296. With 2 plates, comprising 10 figs.

Plimmer first contributes some general notes and a brief history of the literature dealing with the genus *Toxoplasma* since the organisms were first seen by SPLENDORE in 1908. He believes that they are more nearly related to the haemogregarines than to any other of the Haemosporidia. They are generally found in the large mononuclear leucocytes and they give rise to very marked wasting and to considerable blood destruction.

On account of the very fine, delicate and sometimes vacuolated nature of the protoplasm fixation is difficult, and the best method of fixing was found to be by means of the vapour of iodine dissolved in chloroform, as described previously by the author [see this *Bulletin*, Vol. 1, p. 282].

In many of the organisms the nucleus is either broken up into granules or the cell gets filled up with granules which take chromatin stains. These granules may be the so-called "infective" granules, such as have been described by FRY and RANKEN in trypanosomes.

There is a tendency for the leucocytes which have become enormously enlarged owing to the invasion by the parasites to mass themselves together, but no true giant cells are formed. Multiplication is effected ordinarily by longitudinal division. The nucleus first enlarges, then becomes rod-shaped, later of a dumb-bell shape and eventually the daughter nuclei are formed, the cell having already begun to divide. No flagellated forms have been seen. Many attempts at cultivation in various media were made but none were successful. The varieties described were found in the following animals in the course of post-mortem examinations of animals which had died in the Zoological Gardens, London.

"(I) Fossa (*Cryptoprocta ferox*), from Madagascar.

"The animal was very wasted. Both pleural, peritoneal, and pericardial cavities contained a quantity of blood-stained fluid. The lungs and kidneys were very congested, and there was a layer of lymph on the under-surface of the diaphragm. The blood was extremely anaemic and contained many poikilocytes and nucleated erythrocytes. A few toxoplasmas were found in the blood; many were found in the blood from the lung, and in the pleural and peritoneal exudation, and in the bone-marrow. Few were found free; nearly all were contained in the large mononuclear leucocytes, often a great number, as many as 36, in a single leucocyte. The leucocytes were very much enlarged, and their protoplasm was extremely thin and delicate, many being ruptured in the preparation of the film, even with the greatest care. The nucleus of the leucocyte invariably showed signs of hyperchromatosis, often very marked. The nucleus of the parasite was often broken up into granules, or chromidia, but many showed the single dot form with a clear area around. Sometimes the *Toxoplasma* was found in the nucleus itself. Schizonts were found in the bone-marrow in various stages up to the apparent breaking up into merozoites. Occasionally the parasites were found in the polynuclear cells in the bone-marrow; this was possibly a phagocytic process, as the shapes of the ingested parasites were much altered."

The organism varied from 2 to 8 microns in length from end to end and from 1·4 to 2·5 microns in breadth at the middle.

"(II) Blue-tailed Fruit Pigeon (*Carpophaga concinna*), from the Aru Islands.

"Died in an emaciated condition. The lungs were very congested, and contained a very large quantity of exudation.

"There was some bloody fluid in the body cavity. Very few parasites were found in the blood, but large numbers were present in the blood and exudation from the lungs. Some were found free, but they were mostly contained in the large mononuclear leucocytes. These cells had undergone more destruction than was the case in the fossa, and the blood was extremely anaemic. The nucleus of the *Toxoplasma* was generally single and definite, and was not broken up into granules. A few were found in the bone-marrow, but none showing definite schizogony."

The length varied from 3 to 8 microns and the breadth from 2 to 3 microns.

"(III) Say's Snake (*Columber melanoleucus*), from Mexico.

"The snake was very wasted, and its blood, which was very anaemic, contained a few haemogregarines. The lung was pneumonic and full of exudation; the liver was small and pale. Toxoplasmas were found in small numbers in the exudation of the lung, and in enormous numbers in the liver; a few single ones in the blood."

The organism varied from 7 to 10 microns in length and from 3 to 6 microns in breadth. The measurements were made on fresh *unfixed* organisms.

In an addendum the author states that since this paper was sent for publication he has found toxoplasms in another bird, a Pied Bush Chat (*Pratincola caprata*) from India. They were found in the blood and exudation from the lungs, which were inflamed and oedematous, and in the mononuclear leucocytes as before. Further early stages of schizogony were found in the large endothelial cells in the lungs.

(g) TRY PANOSOMIASIS.

- (269) BOUIN. Trypanosomiase des dromadaires au Maroc occidental.
[Trypanosomiasis of Dromedaries in Western Morocco.]—*Rec. Méd. Vét.* 1916. Aug. & Sept. Vol. 92. Nos. 15 & 16. pp. 463-466.

In this short paper the author describes a disease which apparently has not hitherto been identified in Western Morocco, and which was found in dromedaries in the district of Marrakech.

The disease is well-known to the natives under the name of "El Debab" and is considered fatal. The symptoms presented and the microscopical characters of the causal organism lead one to believe that it is almost certainly identical with the "El Debab" described by the brothers SERGENT in Algeria. Cross immunity tests would, however, be necessary to support this conclusion.

Symptoms.—The disease runs an essentially chronic course, the symptoms being those of a slow and progressive anaemia. To commence with the affected animals show no visible symptom, the appetite being kept up and condition good. This preliminary period seems to last a long time. One of the first noticeable symptoms is lessening of the appetite and reluctance of the animal to work. The loss of appetite is gradual and the animal loses condition until it presents a markedly emaciated appearance ; the coat is rough. One repeatedly notices petechiae on the conjunctiva.

The first dromedary found affected was in this condition of extreme debility. Microscopic examination of the blood showed an extraordinary number of trypanosomes. Trypanosomes were found in the case of two dromedaries out of four belonging to the same proprietor. These cases, however, did not show any sign of anaemia but had good appetites, normal mucous membranes, and well preserved condition.

These three cases were examined after an interval of five months ; the latter two did not manifest any external symptom and continued at work. The first case had been sent out to grass and had become still further emaciated ; this animal was about twelve years old. The other two were from five to six years old.

The author believes that this trypanosomiasis is thus a disease which runs a very slow course since a dromedary which presented serious symptoms was found after five months, interval to be in an almost identical condition and two other cases, which had been carriers of trypanosomes for at least five months, did not show any morbid symptom.

Causal agent.—The trypanosome is found by direct examination of the blood of affected animals and is very abundant during the crisis. Morphologically it resembles *T. soudanense*. When examined in the fresh state it is seen to possess pretty rapid wriggling movements, but

scarcely any translatory movements. It shows after staining a fairly short flagellum, some granules and a pretty large and distinct centrosome.

In comparison with *T. marocanum* of the horse it is as a rule longer and thinner, and its flagellum is longer. These distinctions however, are not sufficient to enable one to differentiate the two by simple microscopical examination.

Inoculation experiments were only carried out on the dog, which was found to be very sensitive. A dog thus inoculated intravenously showed a fairly large number of trypanosomes in its blood 27 hours after infection. Except for a slight loss of condition the animal was in good health five months after inoculation. Trypanosomes were revealed in the blood almost every day during the first two months; afterwards the trypanosomes appeared at longer and longer intervals and were less and less numerous. During the fourth and fifth months after inoculation they could only be found five times at intervals of from three to four days. These re-appearances always corresponded with rises of temperature. No symptom was presented except dullness during the crisis.

The author suggests that these very chronic symptoms indicate a feeble virulence of the trypanosome and hence the antiseptics hitherto employed in the case of other blood diseases might with advantage be tried.

(270) CHALMERS (A. J.) & O'FARRELL (W. R.). Measurements of Dutton & Todd's Gambia strain of *Trypanosoma gambiense*, Dutton 1902.—*Jl. Trop. Med. & Hyg.* 1916. Aug. 15. Vol. 19. No. 16. pp. 189-194. With 1 plate, comprising 7 figs., & 5 charts.

In 1914, with reference to the study of trypanosomes in the Khartoum laboratories, the authors published a short note in which the following conclusion appeared:—"There being no data, that we know of, to compare these strains with *T. gambiense*, Dutton 1902, we are of the opinion that, at all events provisionally, it would be safer to keep the name *T. castellanii* Kruse 1903 for these strains until more light is thrown upon the complicated problem of: What is *Trypanosoma gambiense* Dutton 1902?"

The authors have been able to procure from TODD some of the original slides which DUTTON and himself prepared from a rat inoculated with their original strain in the course of their expedition to Sene-gambia, the report of which was published in 1903. The authors have taken measurements of these trypanosomes, and these would be as follows, the organisms being arranged according to BRUCE's three groups:—(1) Stumpy: 13 to 21 microns, 10·2 per cent.; (2) Intermediate: 22 to 24 microns, 28 per cent.; (3) Large: 25 microns and upwards, 61·8 per cent.

These measurements are compared with those given by (1) DUTTON for the original strain, (2) BRUCE for the Uganda strain, (3) STEPHENS and FANTHAM for the Congo strain, (4) the authors for the Lado strain, and also (5) with the strain met with in 1915 by da COSTA and others in the Island of Principe, a strain "which they stated removed itself sensibly from the classic form." The authors conclude as follows:—

"We now consider that the measurements given above afford sufficient

evidence to conclude that the causal agent of sleeping sickness in Uganda, the Congo, the Lado of the Anglo-Egyptian Sudan, Principe, and the Gambia belong to one and the same species, viz., *T. gambiense* Dutton 1902."

- (271) DUKE (H. L.). Trypanosomiasis in Northern Uganda.—*Jl. of Hygiene*. 1916. Sept. Vol. 15. No. 3. pp. 372-387. With 1 map.

Some alarm was apparently caused by the discovery by REFORD (January 1914) in the blood of a dog, which had passed through the Masindi fly belt of Northern Uganda, of a trypanosome showing marked morphological resemblance to the human parasite, the so-called *T. rhodesiense*. Miss ROBERTSON, who had carried out a series of investigations in connection with cattle trypanosomiasis in this region in 1913 and on no single occasion found any evidence either in fly, experimental animals, or cattle of the existence of a trypanosome of the *brucei* group, expressed her agreement with REFORD's view as to the affinities of the organism to the Rhodesian trypanosome. It was thus concluded that this organism had been introduced into the fly belt during the intervening three months or so.

From a history of the movements of herds in this Province, ROBERTSON also inferred that the 10 per cent. infection of the *morsitans* throughout the fly belt, and the cattle trypanosomes infecting about 12 per cent. of stock and causing great havoc in the Buruli and Kafu country, separated from the fly belt by the Kafu river, were originally derived from the South, and had been introduced within comparatively recent years. In her fly feeding experiments mixed infections with *T. pecorum*, *T. vivax*, and *T. uniforme* were obtained and none of the flies on dissection were found to harbour the full developmental cycle of the *brucei*-like organism described by REFORD.

Duke disbelieves this view that the trypanosomes responsible for the disease in cattle, the free-flagellated *brucei*-like organism, and the infection of the fly and game of the belt are the result of a relatively recent introduction. It is inconceivable that a large area of very sparsely populated bush country thick with game and *morsitans* could remain free from trypanosomes. It is also impossible to differentiate trypanosomiasis from other diseases such as rinderpest and babesiosis by means of enquiry among the natives, the experience of the veterinary officers of the Protectorate being that the same terms might cover any of these diseases. Further, infections with such trypanosomes as *T. nanum*, *T. vivax*, and *T. uniforme* do not necessarily involve a fatal result.

The author regards the great fly belt which forms the northern limit of the Buruli-Kafu cattle country as a permanent source of all the trypanosome species found in the country and believes that infection might be carried from this belt across the Kafu River into Central Buruli either by the so-called "following fly" accompanying game or traffic, or by the passage of infected animals, game or cattle.

The author then summarises the results of the investigations which he carried out between May and September 1914 in the Masindi *morsitans* belt and in the other tsetse districts of the Northern Province in order to determine the distribution of the *brucei*-like organism. In very numerous fly feeding experiments in the Masindi belt *T. pecorum*,

nanum, *vivax*, and *uniforme* were frequently recovered and it was found that 0·95 per cent. of the wild *morsitans* were infected with the *brucei*-like trypanosomes. On every occasion where a positive salivary gland was seen in a fly "*T. brucei*" developed in the animal fed upon and dogs also always showed the characteristic symptom of keratitis. The blood of game shot in and around the fly belt when inoculated into clean experimental animals showed a 6·6 per cent. infection with "*T. brucei*."

In the other districts (Ngussi River, region of Tonya peninsula and shore of Lake Albert, Chopi, Victoria Nile, and Bugungu region) other species of *Glossina* were examined (*G. pallidipes*, *G. palpalis*, *G. fusca*) and similar results were obtained.

The author believes that these "facts show that a trypanosome of the *brucei* group is widely distributed throughout the southern part of the Northern Province, probably indeed whenever *G. morsitans* and *pallidipes* are found," and that "speaking generally wherever cattle are exposed to the bites of tsetse especially of the above two species, they sooner or later sicken and die out." Also, the discovery of this trypanosome showing a close affinity to the organism recently isolated from man in South Africa need not cause undue alarm.

In addition, the examination of the natives within this fly belt where the *morsitans* was shown to be infected with the *brucei* organism in the proportion of 0·5 per cent. revealed no sign of any form of trypanosomiasis, acute or chronic.

(272) VAN SACEGHEM (R.). Contribution à l'étude de la transmission du *Trypanosoma Cazalboui*. [The Transmission of *Trypanosoma cazialboui*.]—Bull. Soc. Path. Exot. 1916. Oct. Vol. 9. No. 8. pp. 569-573.

Trypanosomes can be divided up into three categories according to their modes of transmission:—(1) those which seem to become propagated under natural conditions, exclusively by means of *Glossina*, such as *T. brucei-pecaudi*, *congolense-dimorphon*, *rhodesiense*; (2) those which are mechanically transmitted by other species of blood sucking insects—*Tabanus*, *Haematopota*, *Stomoxyx*,—such as *T. evansi*, and *T. equinum*; (3) those which are capable of being propagated indifferently by means of *Glossina* or other blood-sucking insects.

T. cazialboui belongs to this third category. Its evolution in the body of the *Glossina* is quite different from that of trypanosomes restricted entirely to *Glossina*; instead of infecting the whole digestive tract it produces only a direct infection localised to the proboscis.

The experiments of BOUFFARD and PECAUD, BOUET and ROUBAUD have demonstrated the transmission of *T. cazialboui* by means of *Stomoxyx* in the disease known as Souma, and in Erythrea and the Egyptian Soudan cases of this disease have been observed where no *Glossina* is known to exist.

The author himself has made a number of observations on the transmission of a trypanosome which he has named *T. cazialboui* var. *pigritia* in the Zambi district. This trypanosome is chiefly distinguishable from the ordinary form of *T. cazialboui* on account of its being less motile. In this district cases of trypanosomiasis due to the parasite have been observed in herds situated in districts where no

Glossina is known to exist and in places in the interior of the country far away from a river, in a region which is not wooded. The first cases appear each year towards the month of November, and after the month of May no fresh cases are found. The period of danger thus coincides with the rainy season and during the dry season no fresh outbreaks occur.

It was observed that the first cases of trypanosomiasis coincided with the appearance of a Haematopota (*H. perturbans* Edwards), that the places where herds became infected, viz., the neighbourhood of papyrus marshes, harboured this insect and that it did not exist in places where the herds remained healthy. Trypanosomes in a living condition were also found in the intestinal tract of *H. perturbans* captured on animals infected with the above species of trypanosome. This insect is found on cattle and horses and fixes itself preferably on the belly and between the thighs, the bite being extremely painful. The author believes that this insect is the principal propagating agent of *T. cazalboui* var. *pigritia* in the Zambi district.

- (273) VELU (H.) & EYRAUD (R.). Trypanosomiase des chevaux du Maroc. Infestation d'un jeune chien par l'allaitement. [Equine Trypanosomiasis in Morocco. Infection of a Milk-Sucking Pup.]—Bull. Soc. Path. Exot. 1916. Oct. Vol. 9. No. 8. pp. 567-568.

The author refers to the works of NATTAN-LARRIER and LANFRANCHI on the excretion of trypanosomes by means of the milk of infected females.

The following case is recorded. Five days after giving birth to three pups a bitch was infected subcutaneously with 20 cc. of the blood of a goat infected with the trypanosome affecting horses in Morocco. A rise of temperature took place on the third day after injection, and a few parasites appeared in the peripheral blood on the 14th day; they then disappeared but became very numerous again about a month afterwards, and then again for about 15 days before the animal's death, which took place on the 66th day after injection.

One pup was allowed to suck its mother, while the other two were taken away 14 days after birth; these two grew up normally. The first, however, when about two months old seemed to have become stunted in growth and dull, and then gradually became more and more emaciated. When three months old it became affected with conjunctivitis and then keratitis of the right eye. On examination of the blood a few days afterwards a few trypanosomes were found which became more and more numerous until the animal's death at the age of three and a half months.

- (274) HINTZE (K.). Versuche zur Immunisierung gegen Trypanosomeninfektion. [Experiments on Immunisation against Trypanosomiasis.]—Zeitschr. f. Hyg. u. Infektionskr. 1915. Oct. 26. Vol. 80. No. 3. pp. 377-398. With 14 tables.

The author refers to the experiments of BRAUN and TEICHMANN (1912), who first attempted to vaccinate the small laboratory animals by means of dried powdered trypanosomes and claimed to have established an immunity against subsequent trypanosome infection.

SCHILLING at about the same time claimed to have produced immunity by vaccinating with trypanosomes obtained from rats' blood and killed by means of a solution of tartar emetic (1 in 700).

The author himself has performed a number of tests, in some cases with dried trypanosomes and in others with a vaccine obtained from infected animals.

(I) *Experiments with dried nagana vaccine.*—The strain utilised for these tests was obtained from the Hamburg Tropical Institute and was carried on in white rats, in which it regularly produced death on the fourth day. Shortly before death the rat was bled and about 10 cc. of a 3 per cent. sodium citrate solution mixed with the blood. In order to obtain a firm deposit of red corpuscles a few drops of rat-blood-immune rabbit serum were added, and the overlying turbid fluid was decanted off and centrifuged. This fluid contained nearly all the trypanosomes. After centrifugation the trypanosomes collected together in a solid white film above the few remaining red blood corpuscles and they could be easily gathered by means of a capillary pipette containing a little salt solution. The trypanosomes were then placed in a small Achat mortar and dried in a Lautenschläger air apparatus, care being taken that the temperature did not exceed from 38° to 40° C. It was thus ensured that substances very sensitive to heat, such as ferments, were not destroyed. The trypanosomes were then crushed into a fine powder and used for inoculation on the same or on the next day. It was not possible to obtain more than 0·05 grammie of this material from one rat.

The vaccine was made by emulsifying this powder with a little salt solution and it was then injected intraperitoneally. Infection with virulent blood was performed by injecting subcutaneously in the back.

Tests were made on rats, guinea-pigs and rabbits; the results of these experiments are recorded in tabular form. The dose of vaccine injected, number of doses administered, and the interval between attempted immunisation and subsequent infection with virulent blood were graded in the various series of tests and control animals were utilised in each case.

In the case of rats it was found that small quantities of vaccine had no influence on the course of the disease. It was only after the employment of about 0·2 grammie of vaccine and infection after five days that the parasites appeared a few days later in the blood than in the case of the control animals and life was prolonged a few more days. Larger doses did not appear to have any greater effect and in the case of an already infected animal vaccination had no influence on the course of the disease. No animals withstood the infection.

In the case of a guinea-pig a certain amount of resistance seemed to be developed which, however, was not sufficient to prevent infection. The net result was *nil*.

LAVERAN and his co-workers maintain that the dry vaccine contains a toxin. The author found that guinea-pigs became considerably emaciated after intraperitoneal injection of the powder and before infection with virulent blood. The spleen, moreover, became enlarged as is always the case in trypanosomiasis.

Rabbits, vaccinated even with comparatively large doses of dried trypanosomes, wasted and died as in the case of control animals

although, as is invariably the case in nagana in the rabbit, the parasite could only be demonstrated by inoculation of mice.

(II) *Experiments with dried spleen pulp.*—The spleen of rats infected with nagana is always extraordinarily enlarged and numerous trypanosomes in all stages of disintegration can be found in it. Rats' spleens are very suitable for immunisation tests. In guinea-pigs the spleen is always enlarged but it varies considerably in size and weight (0·3 grammes to 13·7 grammes). In rabbits changes in the spleen are less obvious (0·6 to 4·3 grammes) and one comparatively seldom finds parasites in it.

The vaccine was prepared in the same way as the trypanosome powder by trituration and drying in an air apparatus, and then emulsified in a little salt solution.

(IIa) *Rat spleen vaccine.*—When comparatively large doses were employed guinea-pigs acquired a certain degree of immunity against the infective organisms, but this, however, only in one case was sufficiently powerful so that the animal never showed parasites in its blood and was living after nine months. Rabbits were again left quite unprotected by the vaccine.

In the case of guinea-pigs vaccinated with nagana rat spleen and infected subsequently with mal de caderas no protective action was observable.

No immunity was produced in rats.

(IIb) *Guinea-pig spleen.*—Trypanosomes appeared in the blood of a guinea-pig a few days after infection and after remaining a few days gradually disappeared and then re-appeared after a shorter or longer interval; during this interval the animal was killed and the dried spleen used as a vaccine, in some cases alone, or combined with serum in others. This treatment had apparently no effect on the course of the disease in guinea-pigs, while in the case of rats only a slight influence was observable.

(IIc) *Rabbit spleen.*—When injected either in the form of expressed fluid or in the dried form this gave no results.

(III) *Experiments with liver.*—Rat and guinea-pig liver had no visible influence.

(IV) *Experiments with guinea-pig and rabbit sera.*—Serum was obtained during the first parasite-free intervals, and experimental animals were infected at the same time or a few hours after immunisation. No influence on the course of the disease was observed even when very large doses of serum were injected when infection had already resulted..

"The conditions of trypanosome immunity are apparently very uncertain as all strains do not appear to be of the same value for producing vaccine (Schilling)."

With the strain at the author's disposal no lasting immunity could be conferred on an animal. Perhaps better results might have been obtained by the employment of larger doses. It appears that in protozoan diseases very large doses are necessary to produce any sort of immunity and the author believes that the production of such very large quantities of pure vaccine would entail enormous difficulties in practice.

(275) HOFFMANN (G. L.). Chemotherapeutische Studien über die intravenöse Verwendung von Antimontrioxyd bei experimentellen Trypanosomeninfektionen. [Chemico-Therapeutic Studies on the Intravenous Administration of Antimony Trioxide in Experimental Trypanosomiasis.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1915. Aug. 18. Vol. 80. No. 2. pp. 261-279. With 6 tables.

Reference is made to the earliest use (1907) of antimony compounds, especially tartar emetic, and later of their employment in conjunction with arsenic compounds such as atoxyl.

MORGENTHOTH, who studied the use of a large number of antimony compounds, came to the conclusion that they had a more pronounced trypanocide action than the arsenic compounds. Later observers also found that sodium and potassium antimony tartrates exert a specific action on *T. brucei*, causing its disappearance from the peripheral blood a few hours after injection.

A systematic study of the various antimony preparations with reference to their practical value has been made by KOLLE, HARTOCH, ROTHERMUNDT, and SCHUERMANN (see this *Bulletin*, 1914, Vol. 2. Extract 45). These authors found that only the trivalent antimony compounds possessed a pronounced trypanosomicide action, but at the same time they exhibited a very marked toxicity. The pentavalent antimony compounds on the other hand were neither chemico-therapeutically active nor pronouncedly toxic.

An exception to the rule that trivalent compounds were markedly toxic was found in the case of the trioxide of antimony; the last named authors found that this compound was almost atoxic for mice, rats, and, to a great extent, for guinea-pigs. Comparatively small doses, however, in cases of infection with *T. brucei* led to a permanent sterilisation of the blood in experimental animals. In the chronic infections produced by *T. equiperdum* and *T. gambiense* the treatment had to be repeated in order to produce durable results. The very favourable relation between the minimum curative dose and the maximum tolerated dose demonstrated, in the case of nagana in mice, that the trioxide of antimony possessed the largest chemico-therapeutical co-efficient of all the antimony compounds.

It was found that, contrary to what was the case in mice, rats and guinea-pigs, antimony could not be administered intramuscularly in an oily suspension to other animals, especially dogs, rabbits, and monkeys, on account of the severe abscess formation it produced. In these animals the compound had thus to be administered intravenously and according to the experiments of KOLLE and his co-workers it was found that one or two injections of small doses of the trioxide in normal saline solution thus produced curative effects in nagana, as well as in dourine, in rabbits. On account of the fact that the heavy trioxide quickly precipitates in saline solution it might produce dangerous effects owing to the formation of emboli.

Hoffmann then details his own experiments on the employment of antimony trioxide. He employed as media for the suspension of the compound sterile solutions of gum arabic and of sugar. As the result of a series of experiments it was found that the best medium consisted of a mixture of both solutions: the *syrupus simplex* of the Swiss Pharmacopoeia containing 7·50 per cent. of the gum was found to be the most suitable concentration for holding the heavy trioxide in suspension.

Numerous tests on experimental rabbits showed that this suspension medium produced no toxic effects when administered intravenously in such quantities as would be employed for treatment with the trioxide.

As a rule the strength of the emulsion was calculated so that 1 cc. contained 150 mg. of $Sb_2 O_3$. The latter was triturated in a mortar with the solutions and autoclaved (120° C. for 15 minutes). Just before intravenous injection the emulsion was warmed for a couple of minutes in order to expel air bubbles.

Experiments in order to determine the toxicity when administered in this medium showed that considerably larger amounts could be tolerated than when administered in salt solution.

Effect on rabbits infected with nagana.—Rabbits were infected subcutaneously with nagana infected blood. When clinical symptoms had set in, as evidenced by the local lesions such as swelling of the penis and testicles, conjunctivitis, loss of hair, oedema, and swelling of the extremities, and the blood was demonstrated to be infective by mouse inoculation, varying doses of $Sb_2 O_3$ were administered intravenously. The blood was afterwards tested at various intervals by mouse inoculation. It was very clearly brought out by these experiments that even as small a dose as 23 mg. of $Sb_2 O_3$ per kilo. body weight produced a lasting cure; some of the animals were kept under observation up to eight months afterwards. The clinical symptoms disappeared almost immediately after the injection. A few animals that died in the meantime could not be said to have died from antimony poisoning as it was shown that up to 100 mg. per kilo. could be tolerated.

Effects on dourine-infected rabbits.—Rabbits were infected subcutaneously and, as in the preceding experiments, when about a month afterwards decided local lesions appeared, varying doses of $Sb_2 O_3$ were administered intravenously. It was found that a single intravenous injection of about 30 mg. $Sb_2 O_3$ per kilo. produced a permanent cure, as in the case of nagana. Dourine, however, owing to its chronicity is more difficult to influence.

The author thus confirms the opinions of KOLLE and his co-workers that $Sb_2 O_3$ possesses a very powerful therapeutic action as a trypanocide.

PARASITOLOGY.

- (276) THEILER (A.) & ROBERTSON (W.). Investigations into the Life-History of the Wire-Worm in Ostriches.—*Union of South Africa. Dept. of Agric. 3rd and 4th Reports of the Director of Veterinary Research. 1915. Nov. pp. 291–346.* With 9 plates, comprising 22 figs.

In these investigations a detailed study was made of *Trichostrongylus douglasi* (Cobbold), which infests the proventriculus of the ostrich. This parasite causes considerable losses among young ostriches and is thus of great importance economically to the ostrich breeder. The morphological changes occurring in the larva, in its two free-living stages, and in its three parasitic stages, together with those of the adult worm are given. The bionomics of the worm are also dealt with at some length.

The influence of parasiticides and disinfectants was tested on (a) mature larvae, (b) adult worms when removed from the stomach, (c) on the worms and the mucus (stomach coat) covering the surface of the wire-worm infected stomachs, and (d) on the worm in the stomach of the ostrich. A long series of drugs were thus examined and their effect *in vitro* determined and the following drugs were tested by administration to infested ostriches :—(1) Carbolic Acid, (2) Slaked Lime and Sal Ammoniac preceded 24 hours earlier by a bottle of paraffin, (3) Thymol, (4) Beta naphthol, (5) Santonin, (6) Kamala, (7) Flores koso, (8) Liquid Ammonia, and (9) Carbon Bi-Sulphide.

It was found that "the results of the drenching experiments with drugs whose parasiticidal action is without doubt when tested *in vitro* were but slightly effective or totally ineffective when given to the bird. Although it seemed to be possible to check the laying of eggs for a short period yet only in rare cases could a permanent decrease of eggs be noted pointing to a decrease of female worms. From the description given of the habitat of the worms in the glands, under the surface of the mucus layer, such disappointing results were not unforeseen and belong to the practical knowledge of the ostrich breeder."

The following practical deductions for the rearing of ostriches free of wire-worm are drawn up :—

"(1) An ostrich, once infected with wire-worm, will remain infected for a long period, perhaps for years, and during this time it will be a constant source of infection of the pasture on which it drops its faeces.

"(2) There is as yet no treatment which with certainty will expel all wire-worms from an ostrich, and to judge from the position of the wire-worm in the glands and mucosa, it is not likely that such will be found.

"(3) Once a pasture or a run is infected with wire-worm it can remain infected for a long time, both eggs and larvae maintaining the infection.

"(4) The fresh droppings are not infective, and only become so after a while, which is shorter in hot weather and longer in cold weather.

"(5) Only the species ostrich can act as a host for the worm.

"(6) Ostriches can stand an enormous infection of wire-worm, provided they are well fed (feed both worms and birds).

"(7) Ostrich chicks do suffer from wire-worm infection even when well fed, and may succumb from larval infection, viz., before the larvae have reached the adult stage.

"(8) By means of worm-cultures made from droppings of the bird, it can be detected whether a bird is infected with wire-worm. This culture can be made in a simple way by placing the fresh droppings into a wine glass, covering it with a suitable lid to prevent evaporation of the moisture. After a few days the larvae can be seen crawling on the wall of the glass and can be recognised by the naked eye. Their number present gives an indication to what extent a bird is infected.

"From these notes it must be concluded :—

"(1) That wherever ostriches have been running the pasture is infected, and wherever the pasture is infected the birds will be so too.

"(2) It is accordingly not advisable to rear young ostriches on ground where old ostriches have been running and feeding.

"(3) In the case of old infected ostriches but little can be done except to dose them with drugs as hitherto applied (carbolic acid, slaked lime, sal-ammoniac, etc.). Good feeding is essential.

"(4) On ostrich farms where clean ground is no longer available, clean runs for young birds can be prepared and the birds can be reared in such runs until they have reached the age when wire-worms are no longer so dangerous to the birds. The cleaning of the run is best carried out by removing the surface of the ground to the depth of about three inches. Use can be made of disinfectant, but this is less certain.

"(5) The chicks must then be fed with the usual foodstuffs grown on land over which no birds have been running.

"(6) The runs of the chicks must be so placed that infected birds do not come in contact with them, and no flooding takes place.

"(7) These runs must be stocked with chicks reared in an incubator, or chicks removed from the nest immediately after hatching.

"(8) When hens and chicks are kept together, it would be advisable to clean the runs at least every 48 hours (better every 24 hours), by picking up all faeces of the adult birds, which is best done by daily changing the birds from one run to another, whilst the one is cleaned.

"(9) For the purpose of rearing ostriches no large paddocks are required, small runs will be sufficient. We found a run of 100 by 50 feet quite sufficient and successful.

"(10) Chicks reared in this way will also be free of other intestinal worms (*Sclerostomum* and *Tapeworm*).

"(11) An effective control can be carried out by means of the glass cultures as described above."

A series of experiments was performed to show that the suggestions enumerated above could be carried out in practice.

(277) VEGLIA (F.). *Anatomy and Life-History of the *Haemonchus Contortus* (Rud.).—Union of South Africa. Dept. of Agric. 3rd and 4th Reports of the Director of Veterinary Research. 1915. Nov. pp. 347–500.* With 23 plates, comprising 60 figs., and 18 charts.

In this very long article the author details the results of experimental work commenced in 1911 at the instigation of Sir Arnold THEILER, the Director of Veterinary Research for the Union of South Africa, with the object of obtaining accurate data on which a scientific prophylactic treatment for haemonchosis in sheep could be based.

The enormous economic losses caused by this worm are, of course, well known in most parts of the world; hence the author was well justified in devoting such a large amount of patient research to the anatomy, morphology, and cycle of development of the worm. This article, and more especially the parts dealing with the bionomics of the parasite, has been pretty fully extracted in the *Journal of Comparative Pathology and Therapeutics*, 1916, Sept. Vol. 29. Part 3. pp. 265–277. It is felt that insufficient justice could be done to this work by an extract of the length usually inserted in this *Bulletin*.

The work represents probably one of the best studies in veterinary helminthology that has yet been published. A very large part of the work is devoted to anatomical and morphological details, but the chapters dealing with the influence of the environment on the eggs and larvae, migration of the mature larvae, and the parasitic life of the larva and adult worm provide very instructive reading.

(278) BULL (L. B.). *Granulomatous Affection of the Horse—Habronemiasis Granulomatata (Cutaneous Habronemiasis of Railliet).—Jl. Comp. Path. & Therap.* 1916. Sept. 30. Vol. 29. No. 3. pp. 187–199. With 5 figs.

In this article the author describes tumours which affect the glans penis and sheath of the horse in the northern parts of Victoria and South Australia, and probably elsewhere in Australia. They are first met with during the summer and autumn months. In two cases lesions affecting the metacarpal and hock region as well were observed.

The tumours appear suddenly, are of a tough fibromatous nature, and vary in size from that of a pea to that of a walnut when found on the glans penis, and are considerably larger (up to 6·5 cm. in diameter) when seen on the sheath. They are usually ulcerated on the surface. On section small caseous and sometimes calcareous areas are found scattered throughout the dense fibrous mass. A layer of dense fibrous tissue covered the growth found in the metacarpal region.

On microscopical examination the appearances are found to vary with the age of the lesion and in the older lesion it is very difficult to demonstrate the causal organism. Beneath the ulcerated granulating surface one finds hyperplasia of the fixed connective tissue cells together with a marked eosinophile infiltration. In this mass may be found circular areas consisting of embryonic connective tissue cells, with few or no eosinophiles, and also caseous areas surrounded by a zone of reaction composed of epithelioid cells together with some multi-nucleated cells. A calcareous deposit may sometimes be seen in the areas. In the centre of these necrotic or caseous areas may be seen circular or ovoid spaces, at one time occupied by a larval nematode. In the earlier lesions the distinct form of the parasite is seen in the shape of the homogeneous finely ridged cuticle, the underlying musculature, and the primitive alimentary canal.

All the parasites were apparently dead but the retrogressive processes varied considerably in extent. The debris found in the spaces in necrotic areas is no doubt that of a nematode parasite. In the older lesions one may be unable to detect any degenerate parasites or even the spaces which the parasite at one time occupied.

The tissue reaction is far more marked and the necrotic areas are more diffusely scattered in lesions from the sheath than from the penis. The lesion from the metacarpus varied in that there was little formation of new tissue apart from the areas of hyperplastic connective tissue cells and some thickening of the dense subcutaneous connective tissue.

The parasite.—The author was only enabled to examine preserved specimens about four weeks old and hence the parasite was always dead. Specimens separated from the tissue measured approximately 3 mm. long by 40 to 50 μ broad. The anterior extremity tapered slightly towards the head, which was rounded; mouth was surrounded by thin prominent lips; posterior extremity terminated at the tip to form a small bulb furnished with minute spines.

The parasite thus appeared to be an immature nematode closely resembling the sixth larval stage of *Habronema muscae* as found by RANSOM in *Musca domestica*. The mode of entry of these parasites is not known but there seems no doubt that they are accidental and have no power of completing their life history. Their remarkable predilection for the region of the penis and sheath is probably explained by the fact that some biting insects (e.g., *Stomoxys calcitrans*) are known to favour these regions.

No other organisms besides these nematodes were ever found in the lesions. The tumour gradually enlarges and may exist for an indefinite time, although the parasites die out in about four weeks time.

The author refers at length to RAILLIET and DESCZEAUX's views on a similar condition—*Esponja*—found in equines in Brazil [see this *Bulletin*, Vol. 4, No. 3, Extract No. 185], and he considers that the

lesions he describes in this article are of the same nature. It is stated that RAILLIET erred in his anxiety to include all recorded cases under the same head, as the parasites described by other observers in no way resemble stage 6 of *H. muscae*. Also, if the larval nematodes are able to penetrate the skin, as suggested by RAILLIET, it is difficult to explain why so many appear at the same point, as each tumour contains many parasites.

Reference is made to the work of HARVEY JOHNSON who found larval Habronema in *Stomoxys calcitrans* and *Musca domestica*, and a similar form in the cattle fly *M. vetustissima* in Queensland; the author believes that this still further strengthens his contention that the larvae are introduced by biting flies.

Swamp Cancer.—The author has examined histologically sections from the equine granulomata occurring in the Northern Territory of Australia and found that they present the same picture as those of an old habronemic lesion as described above. He thus believes that Swamp Cancer is almost certainly a variation of the same condition.

Prophylaxis and treatment. This should be in the direction of :—
(1) ridding horses of the adult forms of the genus Habronema which are located in the stomach; (2) destruction of faeces which bear the embryos and which act as a breeding ground for flies; (3) complete excision of the lesion before it has become inoperable is the only treatment to be advised.

- (279) JOYEUX (Ch.). *Sur le cycle évolutif de quelques Cestodes. Note préliminaire.* [Life Cycle of Some Cestodes. Preliminary Note.]—*Bull. Soc. Path. Exot.* 1916. Oct. Vol. 9. No. 8. pp. 578–583.

The following tapeworms are dealt with :—(1) *Dipylidium caninum* (L.). (2) *Hymenolepis diminuta* (Rud.), and (3) *Hymenolepis nana* v. Siebold.

In the case of the first of these tapeworms the author has attempted to solve the problem how the rat-louse and rat-flea could become infected with the eggs of Dipylidium in view of the fact that the proboscis of these insects appears too small to allow of the passage of an egg. Infection of the insect was found to take place in the larval stage when the mouth parts are large enough to admit the cestode egg, and the cycle of development in the larva and adult insect was followed.

In the case of the second cestode, affecting the rat and sometimes man, the life-cycle in various insects, including the caterpillar and butterfly, was followed.

The third parasite, affecting man, and most probably it is the same species which affects the rat, is capable of undergoing its complete life-cycle in one host.

- (280) VELU. *Note sur une lesion de Myase intestinale chez le cheval.* [A Lesion due to Intestinal Myiasis in the Horse.]—*Rec. Méd. Vét.* 1916. July 15. pp. 408–410. With 2 figs.

Velu records a case in which tumours were formed in the sub-mucous connective tissue of the duodenum of a horse due to larvae of the species *Gastrophilus veterinus*. These tumours were similar to those caused by *Spiroptera megastoma* in the stomach; two were of about the size of a walnut and the other one about the size of a large egg.

They formed only a slight swelling in the lumen of the intestine and the mucous membrane remained in the same condition as that of the surrounding parts. On section these tumours were seen to be composed of dense fibrous tissue containing a number of inter-communicating small cavities filled with a greyish-white purulent material containing the bots. The channels communicated with the lumen of the intestine by means of very small orifices.

Bots were extremely frequent in Morocco in 1913 owing to the abnormally long dry season, but, as elsewhere, they hardly ever caused any serious symptoms.

MYCOLOGY.

- (281) CAZALBOU (L.). *La Culture Naturelle des Champignons Pathogènes.* [Natural Cultivation of Pathogenic Moulds.]—*Rev. Gén. Méd. Vét.* 1916. Sept. 15. Vol. 25. No. 297. pp. 410-421. With 11 text figs.

The author believes that the advances made in the last few years in the study of the mycology of pathogenic vegetable organisms lead one to consider the microbe as representing, in the living tissues of the affected animal, the degraded form of a mould whose normal evolution must take place in external media. The author then gives a summary of the results of a number of publications he has already made on this subject.

The present work has as its object, by means of a few examples, to make the author's conception more comprehensible, and to point out the primary laws which seem to govern mycoculture. These examples are chosen from among : (A) Dermatophytes (*Trichophyton faviformes*, *Tr. equinum*, *Achorion annulosum*, *A. serisei*, *Microsporon equinum*; (B) Bacillary Bacteriaceae (tubercle bacillus); (C) Yeasts (Rivolta's *Cryptococcus*); (D) Cocco-bacteriaceae (mycetomic coccus of the horse).

Brief descriptions, together with diagrams, illustrating the development of each of the above organisms in artificial culture and in natural culture are given. The following are the author's conclusions :—

"(1) Transplanted directly into cell-culture, in natural conditions of development the organism uses up all the medium in the formation of its vegetable system : (hyphae and special reserves).

"(2) It is only after the complete utilisation of the medium that the mould which has thus satisfied the needs of the individual element inclines towards the formation of organs of preservation (conidia) and of reproduction (true spores).

"It is for this reason that the dermatophytes, even those which grow best in test media, do not grow beyond the vegetative stage.

"(3) The development of a "chlamydospore" hypha seems to indicate that the appropriate medium has not yet been discovered."

- (282) MEYER (K. F.) *The Relation of Animal to Human Sporotrichosis. Studies on American Sporotrichosis III.*—*Jl. Amer. Med. Assoc.* 1915. Aug. 14. Vol. 65. pp. 579-585. With 1 table and 1 map.

In this article the author describes the distribution and spread of sporotrichosis in animals in the United States since 1909 when PAGE,

FROTHINGHAM, and PAIGE described their finding of sporotricha in the pus which had been collected from the abscesses of so-called cases of "epizootic lymphangitis." The epizootiology of the disease is dealt with especially with regard to the possibility of its transmission to man. A review of recorded cases is given and also the detailed history of a laboratory infection, apparently of the author himself, following on manipulation of large quantities of cultures of equine sporotrichosis. The following are the author's conclusions:—

"Spontaneous sporotrichosis of domesticated animals, particularly horses, is very common in certain parts of the United States.

"Extensive bacteriological and serologic experiments have proved the identity of the causative organisms in human and animal sporotrichosis. The pathogenicity for human beings was observed in an accidental laboratory infection.

"The geographic distribution of equine sporotrichosis, which is apparently closely connected with certain telluric and climatic conditions, covers, in two states, the same territories from which numerous cases of human infection have been reported in the last five years. In Pennsylvania, equine sporotrichosis—as so-called "epizootic lymphangitis"—has been noted in as many as 150 cases annually.

"Only two human cases are on record in that state. A careful study of one case suggested at first a contact infection with a sporotrichotic horse, but this assumption could not be proved conclusively. The evidence collected does not support the theory that human sporotrichosis is very frequently transmitted from horse to man in the United States. The cases of Hyde and Davis, Sutton and others are discussed from this point of view, and compared with the cases reported by Gougerot, Carougeau, Lutz and Splendore, and Rouslacroix.

"The absence of sporotrichosis among veterinarians and farmers in Pennsylvania—where equine sporotrichosis is so exceedingly common and so often treated, calling forth undoubtedly close contact with infectious material—demonstrates that sporotrichotic infections in man are established by this channel of contact in rare instances only."

BACTERIAL DISEASE.

UNDULANT FEVER.

- (283) IZAR (G.). *Studi sull' infezione spontanea da micrococco di Bruce negli animali domestici. Nota I.* [Studies on Spontaneous Infections with Bruce's Micrococcus in the Domesticated Animals. Note I.]—*Sperimentale.* 1916. June 9. Vol. 70. No. 2. pp. 137-158. With 5 tables and 1 text fig.

As the result of a resolution passed by the eighth meeting of the Italian Pathological Society urging the immediate adoption of rational prophylactic measures against Malta fever, a Commission was appointed in 1913, with the support of the Italian Government, by the Commune of Catania. The author was entrusted with the directorship of the Pathological and Chemico-Physiological Section.

The author first details the history of the discovery of Malta fever in the blood and milk of goats since ZAMMIT'S original observations, and the striking results obtained at Malta, in accordance with instructions drawn up by the English Royal Commission, and elsewhere by direct prophylactic measures against the infected animals.

Attention is drawn to the experiments of ROSS, HORROCKS and others, in which the milk of goats that was certainly infected failed to transmit the disease to monkeys or man, and ROSS's observations on a regiment in which a greater number of cases of infection was observed in men partaking of boiled milk than in another regiment in which unboiled milk was used. These apparent discrepancies have been explained as being probably due to the action of the gastric juice on the micro-organism.

The plan of campaign adopted by the author with the approval of the Commission as regards sero-bacteriological investigations among milk-producing animals was as follows :—

(1) From every milk-producing animal (goats, cows, asses, sheep) a sample of blood was to be taken from the auricular vein and a specimen of milk in sterilised receptacles, duly sealed and sent to the Institute for examination ; at the same time a special mark was to be placed on the animal.

(2) Animals whose blood gave positive agglutinations in dilutions of over 1 per cent. and whose milk had the same properties in dilutions of over 10 per cent. were to be isolated in a suitable place and subjected to final examinations (cultural tests of the blood, milk, urine, etc.) in order to diagnose the existence of active infection.

(3) Animals thus found actively infected were to be slaughtered or utilised for final studies, compensation being given to the owners. When on the other hand successive examinations, repeatedly made, gave no positive result the suspected animal was to be restored to its owner a month after its isolation.

(4) If at least one-third of the animals in a herd gave positive milk or serum reactions the whole herd was to be isolated and subjected to final examinations.

Difficulty was found in numbering and identifying a large number of animals according to the above plan. (In Catania there are about 14,000 goats.)

As to the importance of the serum reaction the author recalls the results obtained by HORROCKS and KENNEDY, who examined the milk and the blood of 86 goats with the following results : In 42 goats, positive serum and milk reaction ; in 16 goats, positive serum reaction and negative milk reaction ; in 28 goats negative serum and milk reactions. In no case was a positive milk reaction and a negative serum reaction obtained, thus demonstrating that by the milk reaction about 28 per cent. of infected animals escape recognition.

Difficulty was experienced in obtaining milk from all milk-producing animals on account of some having become pregnant or having recently given birth to young. In practice it was found impossible to obtain milk from such animals directly their milk was being used for human consumption. The error might thus be over 28 per cent. The author thus temporarily modified his original programme restricting it to a work of preparation by gathering data to demonstrate the importance of a systematic examination of milk-producing animals. Milk was thus taken by employees under the control of the civil police from such goats as the owners chose to assign to them. The results have thus only a relative value because a good many animals suspected by the

owners did not figure in the tests and because by the mere examination of the milk about 28 per cent. must escape recognition according to the data of HORROCKS and KENNEDY.

Technique. The author examined the various methods proposed for the examination of the milk before commencing his own researches and found that for clearness of result and rapidity in reading the best method of working was with milk serum.

In dealing with numerous specimens of milk a modification of PULVIRENTI's method was found to be preferable. After acidification (by the addition of six to eight drops of acetic acid to 15 cc. of milk) the mixture was kept for two hours at 37° C. and, after shaking, it was centrifuged for a long time. With a small narrow pipette the few tenths of a cc. of the clear serum required for the test are taken out and made up into various dilutions at 1/10, 1/20, 1/40, 1/80. To these dilutions is added an equal number of drops of a thick emulsion of Bruce's micrococcus in normal saline solution obtained by suspending the 48-hour surface agar growth in 3 cc. of normal saline solution. After shaking, the small tubes were left in the incubator for five hours.

The author, using milk serum, considers that an agglutination at 1/10 indicates a positive reaction. Numerous cases of positive reactions up to 1/40 were observed; less numerous cases of positive agglutination up to 1/80, and exceptionally those with still higher values. The only cow found to be infected gave a complete agglutination at a dilution of 1/640. It is important to control the organism from time to time as changes in specific agglutinability may occur in it after being kept in the laboratory. Paradoxical results are also sometimes obtained.

The author next quotes a series of very interesting statistics published by various observers on the occurrence of the infection in various countries in different animals, such as goats, mules, horses, donkeys, cattle, pigs, cats, rabbits, guinea-pigs, sewer rats, fowls, and camels.

The milk-producing animals examined by the author were 1,289, of which 1,253 were goats and 36, cows. Of these 149 goats and 1 cow gave a positive milk reaction, i.e., 11·8 per cent. of the goats examined and 2·7 per cent. of the cows examined which, increased by 18·6 per cent. in the case of the goats, gives a total of 30·4 per cent. of suspected animals.

Tables are given showing the results of tests of animals selected from various herds and the percentage of infected animals in each herd. The author believes that these percentages do not appear extraordinarily high considering the facilities afforded to the goats of infecting each other and also the fact that as a rule the disease develops insidiously without producing any rapid or notable weakening or sudden death of the animals.

The topography of a centre of infection, illustrated with the aid of a diagrammatic plan of an affected area, shows that the disease is closely connected with direct contagion from individual to individual and from herd to herd. From this plan it is seen that in one group of streets the infection almost exclusively struck those herds whose pens were situated at one end of a certain main street and extended into the neighbouring side streets, whilst the herds penned in the neighbourhood of the other end of the main street remained unaffected. Between the two inhabited ends of this main street there intervened a fairly

large uninhabited zone of rocky ground which apparently prevented or delayed the spread of infection from one end of the street to the other.

This simple illustration demonstrates the prophylactic importance of a timely discovery of the first cases of infection in a herd in order to avoid the propagation of the disease amongst all the goats in the herd and amongst the goats penned in the vicinity. The same principle applies to germ carriers, i.e., one should remove and isolate the carrier animals before the infection breaks out and if it has already broken out both carriers and infected should be removed.

In the course of a year the bloods of 268 dogs, 825 oxen, and 35 goats brought for slaughter were examined; 0·7 per cent. of the dogs, 0·12 per cent. of the oxen, and 8·5 per cent. of the goats gave positive reactions. The majority of the cattle, however, were imported from Serbia and Bulgaria where Malta fever is not known to exist, and not from the Sicilian countryside.

DISEASES DUE TO ULTRAVISIBLE VIRUSES.

(a) FOOT AND MOUTH DISEASE.

- (284) TERNI (C.). *Ricerche ed esperienze per lo studio della immunità all' afta.* [Immunity against Foot-and-Mouth Disease.]—*Clinica Vet.* 1916. May 15. Vol. 39. No. 9. pp. 257-261.

The conclusions drawn by Cosco and Aguzzi in their preliminary note [see this *Bulletin*, Vol. 4, No. 2, Extract No. 115] correspond with the results of a series of observations made by the author while carrying out investigations under the direction of the "Italian Commission for the Study of Immunity against Foot-and-mouth Disease." The following are his conclusions:—

"(1) The virus of foot-and-mouth disease can be preserved indefinitely by 'passage' in series through susceptible animals, either with blood products (serum or red corpuscles) or with the products of local lesions. The best method of preserving the virulence for controlling the activity is *lingual inoculation*, either with blood taken when the temperature rises above 40° C. or with the products of the local lesions. The maximum virulence is obtained with the epithelium of the digestive tract (tongue, rumen).

"(2) The 'passage' or fixed virus is obtainable with its maximum infectivity, virulence, and power of diffusion after 24 to 36 hours. It almost invariably kills young animals (calves, lambs, kids, sucking pigs) by a generalised infection with constant presence of the virus in the blood.

"(3) Experiments now undertaken seem to show that other species of animals can maintain the virus in a virulent state for a variable time without manifesting apparent external lesions.

"(4) It is possible by inoculation of the products of blood stored in the incubator or in the cold until the virulence has disappeared to obtain in animals a resistance capable of withstanding direct inoculation of the virus or infection by cohabitation with animals affected with acute forms of the disease.

"(5) The serum of bovines that have passed over the febrile period of the disease has a notable preventive and curative power against the virus of foot-and-mouth disease, even of a malignant nature. The inoculation of whole blood or of serum preserves adult animals with certainty from death and promotes a rapid cure.

"(6) Two forms of immunity can be distinguished : the one is general and resides in the blood, and the other is of a more strictly histogenetic nature and is related to the epithelia protecting the digestive tract. The latter is more fragile than that of the blood and is strictly relative to the regeneration of the epithelial cells. In bovines as the result of lingual inoculation one observes a gradual loss of immunity, at first of the lingual epithelium, then of the rumen and small intestine, and then of the tissues of the coronary band. This is why it is that in natural conditions one may see animals affected with serious natural manifestations, especially of the lingual epithelium, without the passage of the virus into the blood, because there still persists a sufficient degree of immunity to protect the animal from a general infection, or because the virus only penetrates for a very short time and in an attenuated condition. These are the cases in which the febrile reaction is insignificant or entirely absent.

"The clinical forms of the disease (external, internal or malignant) are in direct relation to the degree of immunity existing in the tissues and in the blood. In an animal which has never been infected or has completely lost its immunity the smallest lesion of the buccal epithelium or of the rumen allows of the establishment of a primary centre of infection, which in a few hours afterwards provokes an infection of the blood as shown by the access of fever. When, on the other hand, as frequently happens after the first attack, there still persists in the blood a certain degree of immunity the centre of infection involving one or several points on the epithelium of the anterior digestive tract remains localised ; but, the virus can acquire even by this first passage an increase of infectivity for other susceptible animals.

"(7) On the contrary in order to procure a malignant strain of virus, that is to say, one which has the maximum infective and diffusive power, it is preferable to associate the blood products with material from local lesions and thus utilise the substance elaborated in the predilection seats to obtain an increase of local histogenetic immunity. This prevents with certainty and for long duration the external lesions, which have serious consequences for the affected animals and cause widespread diffusion of the virus.

"(8) In the case of adult animals that have died from the apoplectic form after a prolonged interval the virus may be altogether absent from the blood but can be found localised in different organs, especially in the cardiac muscle, brain, liver, kidneys and even in the spleen and bone marrow. In the blood the maximum virulence is found in the portal veins. The elimination of the virus from the blood takes place for the most part by means of the kidneys and to a smaller extent by the milk and the saliva, which only becomes infective in the majority of cases as the result of local lesions."

(b) FOWL PLAGUE.

(285) BELFANTI (S.) & ASCOLI (A.). *Spigolature nella Peste Aviaria e nell'Afta.* [Notes on Fowl Plague and Foot-and-Mouth Disease.] — *Clinica Vet.* 1916, Oct. 15. Vol. 39. No. 19. pp. 577-597. With 5 tables & 2 charts.

Fowl Plague.—Some preliminary experiments were conducted on fowl plague with the object of obtaining some useful information on foot-and-mouth disease, especially with regard to immunity against it.

Reference is made to the works of LANDSTEINER, who showed that the virus in fowl plague was largely localised in the red blood corpuscles of affected animals. MAGGIORA and VALENTI, in the case of young geese in which the disease runs a less rapid course and presents a nervous form, showed that the virus which is at first localised in the blood disappears from it later to establish itself in the central nervous system ; this is on a parallel with the virus of foot-and-mouth disease which, according to COSCO and AGUZZI, is present in the blood during

the febrile period but during the eruptive stage disappears from it and is only found in the local lesions, on the mouth or feet. KLEINE and MOELLERS, by daily examination of the blood of infected young geese, confirmed these statements but found that in a few cases the virus re-appeared in the blood shortly before death, i.e., in from five to seven days.

The authors' experiments were all made on fowls; the virulence of the blood *in toto* was tested as well as the virulence of its various constituents, that is to say, of the red corpuscles, of the serum, and of the leucocytes. Some tests were concerned with the virulence of the brain and a special series dealt with the waters of centrifugation of the blood. The results of these experiments are recorded on the tables. It was noted that all produced fatal results in from 12 to 108 hours. The enormous virulence of the red blood corpuscles was evidenced in that a dose of 1 cc. was capable of producing death even when diluted 5^{15} times (that is, with an actual dose of 0.0000000016384 cc.). This high virulence had previously been pointed out by LANDSTEINER, MAGGIORA and RUSS.

The waters of centrifugation also proved extraordinarily virulent, even up to the thirtieth washing, the highest one tried, although care was taken that they contained no corpuscular elements.

The authors believe that this last phenomenon may be due to the fact that a small quantity of the micro-organism remains in suspension in the medium after each washing. They also believe that the alleged success claimed by MARCHOUX in the cultivation of the virus in 2% glucose agar containing 1% peptone could be attributed to the same facts, even though he claimed that his cultures were virulent after 10 passages. These cultural experiments were repeated by the authors, but no multiplication of the virus could be demonstrated by means of Gosio's tellurite indicator. Similarly negative results were obtained in Noguchi's medium. The theory of MROWKA and SANFELICE suggesting that the virus might in reality be a matter of protein grouping, such as globulins, is recalled.

A fair number of experiments were devoted to attempts to immunise fowls against fowl plague, the material used being infected blood, brain, and liver. An attempt to vaccinate with red corpuscles suitably diluted failed, and then vaccination with virus killed by ether was tried, as suggested by SCLAVO, used by VINCENT for the preparation of typhoid vaccine, and recently employed by CAMUS and FORNET for the purification of Jennerian vaccine. The results of a single vaccination were indecisive but appreciable effects were obtained with two vaccinations, in that death took place with a quite noteworthy delay as compared with the controls.

Foot-and-mouth Disease.—The authors' experiments on this subject were rather limited, and were confined to attempts at the immunisation of pigs.

Attempts at cultivation of the virus proved negative.

Serum obtained from LOEFFLER, even when administered in large doses (50 to 60 cc. per head), proved quite ineffective.

As a result of their experiments on pigs inoculated intravenously with virus of bovine origin the authors concluded that, as regards immunisation, what happened was in no way analogous to the results obtained in the fowl plague experiments. The only positive results were

obtained in cases where blood or washed red blood corpuscles preserved at ordinary temperature or in the incubator were employed. The foot-and-mouth disease virus did not seem to be in any way affected by the action of ether, as it preserved its infectivity almost unaltered.

With regard to the apparent immunising effect of blood in their experiments, the authors refer to the successes obtained by DEL BONO, PERRONCITO, and TABUSSO in a large outbreak in 1901, in which the curative and preventive effect of blood inoculation was very marked.

- (286) COMINOTTI (L.). *Peste aviaria nella anitre.* [Fowl Plague in Ducks.]—*Clinica Vet.* 1916. Mar. 15. Vol. 39. No. 5. pp. 129-135. With 2 figs.

The author studied an outbreak of fowl plague among the ducks on the lake of the Public Gardens of Milan; 50 per cent. of the birds became affected. A brief survey of the literature connected with the subject is given. The following are the author's conclusions:—

"(1) Fowl plague may attack wild ducks placed in the same conditions as domesticated birds.

"(2) The clinical form in which the disease manifests itself in these animals is the nervous form.

"(3) The morbid anatomy of the disease shows nothing characteristic.

"(4) The virus cannot be found in the blood or in the internal organs, even when quantities exceeding those employed in working with the disease in geese are used. It is found, however, in the central nervous system.

"(5) The transmission of the infection to fowls is possible by means of subcutaneous injection of emulsions of the cerebral substance of infected ducks; on the contrary it is not possible to transmit it to the domesticated duck, however large a dose of virus is employed, either by ingestion, intravenous inoculation, instillation on to the conjunctiva, or even by intra-cerebral inoculation."

(c) VARIOLAE.

- (287) AMAND & HUON. *Asino-vaccine.* [Ass-Vaccine.]—*Bull. Acad. Méd.* 1916. July 25. (Report extracted in *Rev. Gén. Méd. Vét.* 1916. Sept. 15. Vol. 25. No. 297. pp. 443-444.)

"Since 1906, Amand and Huon have tried to utilise vaccine from the ass in order to regenerate the activity of vaccinal pulps. The ass vaccine, used as seed material, gives on the calf very remarkable cultures of vaccinia while at the same time it confers quite a special activity upon the virus; moreover, ass vaccine utilised in public vaccinations gives vaccinal reactions in cases where the bovo-vaccine remains powerless.

"Their practice extending over several years at Marseilles, that is to say, thousands of observations, have confirmed all these data and demonstrated better than could any discussion the remarkable activity of the ass vaccine; at the same time all these observations have given proof of the complete absence of accidents when one uses it on a large scale for human vaccination."

- (288) WURTZ (R.) & HUON (E.). *La variolisation des génisses immunisées contre la vaccine.* [Variolisation of Calves immunised against Vaccinia.]—*C. R. Acad. Sci.* 1916. Sept. 18. (Report extracted in *Rev. Gén. Méd. Vét.* 1916. Oct. 15. Vol. 25. No. 298. p. 490.)

"It is known that the vaccination of calves with the Jenner vaccine confers upon them after a relatively short space of time a lasting immunity. The precise and repeated experiments of Kelsch, Camus, and Tanon have shown that immunity is always acquired on the eighth day.

"With these facts in mind, the authors, by inoculating a variola into calves vaccinated eight days beforehand with the Jenner vaccine, produced in them the variola.

"Proof that it is in reality a variolar eruption is furnished by the clinical course of the disease and the appearance of the eruption, by the morbid anatomy of the eruptive elements, and the results following their inoculation into the monkey and the rabbit.

"It appears strange that the Jenner virus after having immunised the body fluids against vaccinia sensitises these fluids on the contrary against variola, but this occurs for a very short time only.

"It seems legitimate to deduct from these experiments that variola and vaccinia are due to two totally different organisms.

"The serum of animals thus variolised has given very promising results, when used in the case of the monkey and the human subject, from the point of view of treatment of variola."

MISCELLANEOUS DISEASES.

- (289) MITCHELL (D. T.). Investigations into Jagziekte or Chronic Catarrhal-Pneumonia of Sheep.—*Union of South Africa. Dept. of Agric. 3rd and 4th Repts. of the Director of Veterinary Research.* 1915. Nov. pp. 583-614. With 4 tables and 2 plates comprising 8 figs.

The above disease affects sheep in various districts in the Cape Province, Free State and Transvaal. It has previously been investigated by HUTCHEON, and ROBERTSON (1904).

The symptoms shown are briefly those of gradually progressing respiratory distress—giving the animal the appearance of having been driven, hence the Dutch name Jagziekte (*jagt*, to drive; and *ziekte*, a sickness)—a mucous discharge from the nostril, coughing, debility, anaemia, and sometimes loss of patches of wool and diarrhoea. Cases usually occur singly, and outbreaks involving a large number of sheep in the same flock are unknown. The animals attacked are generally about three years old; no cases have been noted to occur among lambs. Young sheep in good condition do not usually become infected under natural conditions, but no difference in susceptibility due to age or condition could be observed among the experimental animals. Statistics from the infected areas show an average mortality of 1·6 per cent. per annum. The disease is invariably fatal.

The disease has to be differentiated from the caseous lymphadenitis of NOCARD, and a condition sometimes produced by extensive infection of the lungs with cysts of the *Taenia echinococcus*.

The author has devoted a considerable amount of attention to a study of the morbid anatomy and histology of the disease. Briefly the lesions consist of a patchy or lobular pneumonia; each lesion in the lung varies from the size of a haricot bean upwards and on closer examination is seen to be composed of small greyish translucent nodules, each about the size of a millet seed. There is also a pleurisy with the formation of fibrous adhesions overlying the affected parts of the lung.

The presence of these nodules of a lymphoid nature in the pneumonic area is stated to be characteristic. The nodules may develop in connection with the bronchi or in the inter-alveolar connective tissue.

The other changes in the lung tissue are those of a broncho-pneumonia, viz., exudation of catarrhal products into the alveoli, and later, fibroid changes, bronchitis, and peri-bronchitis. As the disease progresses the lesion becomes hard and dense, almost cartilaginous in consistence. Lesions of emphysema and atelectasis occur in the healthy lung tissue at some distance away from the main lesion and pleurisy is constantly present. Sometimes abscess formation in the lungs, due to the presence of the Nocard-Preiz bacillus, was noted.

The period of incubation is difficult to determine but from the author's experiments it was deduced that lesions might be found in in-contacts in from three to five days.

Experimental work.—A series of experiments was performed in which various products from the affected animals, such as emulsions of glands, blood, bronchial mucus, and of lung lesions were administered to healthy sheep by drenching, or inoculation subcutaneously, intravenously or intratracheally. Altogether 72 sheep were treated in this way and the results in all cases were negative except in the case of one sheep. This sheep had been used in three other experiments and it was concluded that the infection was accidental.

Experiments were next performed to ascertain if infected sheep when placed in contact with healthy animals were capable of transmitting the infection, and, if so, in what time lesions of jagziekte became evident. Infected and healthy sheep were thus kept together in four loose boxes and slaughter of in-contacts from each box was carried out at intervals of two, eight, and ten days respectively and a careful post-mortem examination made in each case. Two animals which had been eight days, and one which had been ten days in contact were found to have lesions in the lungs. It was thus concluded that the disease is capable of being transmitted from infected to healthy sheep by immediate contact, and that it is possible that macroscopic lesions could be detected after a period of about five days in contact.

A further experiment was performed in order to ascertain whether a loose box in which affected animals had been kept for some time was capable of conveying the infection to healthy sheep. It was found that two sheep out of 10 kept in an infected box contracted the disease, the first case being observed in a sheep which had been 10 days in contact and the second case in one which had been 30 days in contact.

This proves that the contagion is fixed and persists in a form capable of communicating the disease for some time after infected animals are removed.

Conditions of transmission thus point to a specific virus being the cause. No parasites could, however, be found in the lesions and microscopic and cultural examinations for the presence of organisms have hitherto been negative.

- (290) MORI (N.). Esistenza della pleuropolmonite essudativa delle capre nell' Italia, centrale e meridionale. [The Existence of Exudative Pleuro-Pneumonia in Goats in Central and Southern Italy.] — *Nuovo Ercolani*. 1916. Jan. 31. Vol. 21. No. 3. pp. 37-41.
- . Sulla etiologia e sulla profilassi specifica della pleuropolmonite essudativa delle capre. [Etiology and Special Prophylaxis of Exudative Pleuro-Pneumonia of Goats.] — *Ibid.* April 30; May 10 and 20. Nos. 12, 13, 14. pp. 196-198; 205-211, and 221-228.
- . Natura ifomicetica dei corpuscoli della pleuropolmonite essudativa delle capre. Il germe specifico della malattia e' un aspergillo. [Hypomycetic Nature of the Corpuscles in Exudative Pleuro-Pneumonia of Goats. The Specific Organism of the Disease is an Aspergillus.] — *Pathologica*. 1916. Oct. 1. Vol. 8. No. 189. pp. 311-315.

The author points out the existence of a disease affecting goats in Central and Southern Italy which corresponds with the disease known as *Boufrida* in Algeria and with the various outbreaks of pleuropneumonia in goats observed and studied in Germany by PUSCH, STORCH and HOLZENDORF in 1894-95 and in the Lower Pyrenees by LECLAIRCHE in 1897. Attempts at prophylaxis and cure by means of a serous exudate obtained from the pleura of affected animals are also described.

Etiology. Various organisms were found at times in the lesions of animals dead of the disease but these were held to be secondary or due to post-mortem invasion. The author describes the presence of corpuscular elements in the specific lesions of the lungs, in the contents of the bronchi, and also in the fibrinous exudate on the pleura, where they are more easily seen. These corpuscles vary in size from about 1/10th of a leucocyte down to those that are almost invisible under high powers of the microscope. When examined in the fresh state they appear rounded or slightly oval, of a greenish colour, very refractile and surrounded by an evanescent halo. They are found especially in the cytoplasm of the polynuclear leucocytes, in the so-called transition forms, in detached epithelial and endothelial cells, and also free. They appear to be attached in varying numbers to the periphery of the cells which seems to be protuberant. They are immotile but the free-lying ones exhibit Brownian movements. Attempts at staining with the ordinary dyes proved unsuccessful, except that a few elements were partially stained by the Ziehl-Mori method. In deeply stained preparations they show up very clearly as negative refractile images surrounded by the stained tissue elements.

These corpuscles appear to be very similar to those discovered by the author in pus from cutaneous lesions of equine epizootic lymphangitis, in that they have the same aspect as the bodies found in the interior of the hyphae and conidia of the hypomycetes which he isolated. They might also be compared with some of the intracellular elements described in some diseases due to filterable viruses.

Attempts at cultivation were made by placing aseptically small pieces of the fibrinous exudate in a liquid medium ordinarily capable of preserving the tissue elements intact. In the majority of cases it

was found on incubation that the material became disintegrated and produced turbidity in the liquid. On examining the deposit the fibrinous network was found to have disappeared and the cytoplasm of the cells broken up thus liberating the corpuscles. No other organisms were found. Increase in number seemed to take place. On staining with Ziehl-Mori they appeared distinctly acid-fast. The author believes that cultivation of the corpuscles had really taken place owing to their apparent increase in number, and the disintegration of the fibrinous exudate.

On transplantation into liquid media a slight turbidity and deposit were produced which on microscopic examination revealed corpuscles as in the first culture, and other rare variable wavy forms similar to those described in cultures of the virus of bovine pleuro-pneumonia.

Transmission of the disease. Former observers maintained that it was impossible to transmit the disease even by inoculation of material from lesions. The author's experiments showed that it was possible only to obtain a thermal reaction by intra-pleural inoculation after a few days, and other slight phenomena. By intra-pulmonary and intra-cardiac inoculation a more intense reaction was produced, although not comparable to what is observed in the natural disease. Intra-pulmonary and intravenous inoculation of serous exudate diluted and passed through a Berkfeld filter produced a febrile condition which lasted some days but no other noteworthy symptoms.

Whilst the rabbit, pigeon, and dog did not react to the inoculation of various pathological products some guinea-pigs inoculated sub-cutaneously, or into the lungs or pleural cavity, died within 15 to 20 days without showing any characteristic symptoms, or visible lesions on post-mortem examination; no organisms could be cultivated on ordinary media.

The inoculation of the acid-fast bodies after cultivation produced in goats a disease similar in most appearances to the natural disease but the complete clinical and anatomo-pathological picture was not produced. Two guinea-pigs inoculated with a 28 days culture of corpuscles died on the 19th day, both having showed identical symptoms, not comparable, however, to those of the natural disease in goats.

The author recalls the fact that in a similar disease, viz., bovine contagious pleuro-pneumonia, it is not possible to reproduce the typical symptoms of the natural disease no matter in what way the virus is inoculated. It is also probable that the virus of exudative pleuro-pneumonia of goats at some stage of its existence possesses the character of filterability, in view of the febrile reaction shown by goats inoculated with filtered pleuritic exudate.

Nature of specific corpuscles. In one of these papers the author expresses the view that the corpuscles presented a good deal of resemblance to certain minute bodies seen in certain hyphomycetes and blastomycetes and found in the body in diseases due to filterable virus. He claims to have isolated in a state of purity from two goats suffering from the typical disease a particular pathogenic aspergillus, greyish-green on culture, easily cultivated after isolation, even on ordinary media. This aspergillus, contrary to the known aspergilli, which only cause pseudo-tuberculous lesions, is instead capable of producing in goats extensive pulmonary hepatisation and pleuritic

lesions similar to those observed in the natural disease; when the conidiospores were inoculated intra-tracheally or into the pulmonary parenchyma death took place in about three days.

Corpuscles similar to those found in the pathological products of the natural disease were observed in pure cultures of the aspergillus isolated, both in the interior of the hyphae and free-lying. They were also found in the lungs and pleura of the inoculated goats. Very few hyphae were found in the lesions as these seemed to have become disintegrated, setting free the corpuscles. A full description of the experiments, etc., is promised in a later communication.

(291) CONREUR (Ch.). *Cachexie osseuse des équidés. Cachexie vermineuse des équidés. Cylicostomose.* [Equine Osseous Cachexia. Equine Verminous Cachexia. Cylicostomiasis.]—*Bull. Soc. Path. Exot.* 1916. Oct. Vol. 9. No. 8. pp. 600-633.

In this memoir the author describes a disease of horses, mules, and asses occurring in Brazil, where it is known under the name of "*Cara inchada*" or "big head." It is apparently the same affection as what is known variously in other countries under the name of osteoporosis, osteoclastia, osseous cachexia, osteomalacia, enzootic ostitis, or gout. The name "cylicostomiasis" is given to the disease to indicate the verminous origin which the author attributes to it.

Cases of the disease among mules and asses are comparatively rare, although a number of cases are on record. The disease particularly attacks young horses and it appears in them as a rule between the ages of two and two-and-a-half years. The incidence of the disease becomes proportionately less as the animal gets older. Young imported thoroughbred horses placed in a contaminated medium are easily attacked and frequently show symptoms from five to six months after their arrival. Young heavy and cross-bred horses are also fairly easily attacked and may become affected with "big head" less than a year after their arrival. Horses of the above type born and bred in Brazil may also show signs of the disease before they are two years old. Brood mares, even when they have reached adult age, are more predisposed to contract the disease than entirest. Native animals seem to offer far more resistance to infection.

Etiology.—The author discusses the various theories which have been put forward to account for this disease, viz., (1) that of ZUNDEL (1870), still supported by MOUSSU and others, which attributes the disease to incomplete nutrition from a chemical point of view (absence or deficiency of calcium phosphate), and (2) the bacterial theory in which either a staphylococcus, micrococcus, or diplococcus found in the bone lesions of certain animals dead of the disease has been incriminated. In support of the chemical theory it has been put forward that change of pasture or rearing on artificial pastures frequently prevents or cures the disease. It is pointed out, however, that the young thoroughbreds imported into Brazil were always supplied with abundant nourishment of good quality. The various organisms described by CAROUGEAU, CARINI, and others were found only in some cases and only at a late stage of the disease.

The bacterial theory fails to explain the following points:—
(1) spontaneous recoveries of infected animals when transferred from

an infected district into another district ; (2) the capacity a healthy animal, which has never shown any signs of osteoporosis and has lived in contact with healthy animals, has of contaminating young animals that perchance come into contact with it ; (3) the absence of the disease in foals and yearlings, its frequency in animals two to three-and-a-half years old, and its lesser frequency at later ages ; (4) foals born from affected mothers are perfectly healthy and develop normally ; (5) improvements in cultivation and the formation of artificial and temporary pastures, artificial manuring and drainage diminish the number and severity of the cases.

These various points, which are difficult to explain bacteriologically, are on the other hand in perfect analogy with the conditions that prevail in certain parasitic diseases such as strongylosis and haemonchosis of lambs, oesophagostomiasis and verminous bronchopneumonia of bovines, etc. In the human subject cases of osteoporosis and osteomalacia due to well-known parasitic diseases occur.

The author, in a number of cases examined post-mortem, has always been able to find innumerable small worms of the genus *Cylicostomum*, in addition to other worms such as Taeniae, Anoplocephalinae, Oxyuridae, Ascarides and Strongyles. The constant genus of nematodes found in affected animals was represented by *Cylicostomum tetraecanthum*.

Symptoms.—These may be divided into four stages : (1) premonitory, (2) lameness and locomotor derangements, (3) osteoporosis and fractures, and (4) osteomalacia.

(1) In the initial or premonitory stage the young horses are noticed to waste away rapidly, feed irregularly and remain lying down longer than ordinarily. Signs of slight colic, sudden lameness, and periostitis of the cannon and pastern bones are then seen. Rest produces a temporary amelioration.

(2) In the second stage, or stage of lameness and medullary derangement, or pseudo-rheumatismal stage, the young animals, which had commenced apparently to recover, now have a recurrence of lameness ; very often they appear affected in the back and seem to have twisted the vertebral column. Vegetating periostites appear on the bones of the extremities ; some are attacked with colic and intermittent diarrhoea. Various vices such as eating earth, self abuse, etc., may appear. The superficial lymphatic glands and the thyroids are enlarged ; certain nervous symptoms appear such as locomotor ataxia, recurrent lameness, paresis, etc. Probably the roaring observed in some cases is attributable to the disease. The animal turns with difficulty in its box as if suffering from pain of the vertebral column or muscles of the back. Several of the cases show signs of "jinked" back. These symptoms may last from three to five months or longer.

(3) The stage of osteoporosis, fractures, and "big head." During this stage, which occurs some time after the occurrence of lesions in parts where there is most strain, such as at the insertions of tendons and ligaments and around the joints, is noticed the tumefaction of the maxillary bones, and this very often coincides with the change from temporary to permanent teeth. Osteomyelitis sets in around the alveoli of the molars, but this is in reality one of the last symptoms to appear. In horses which are not put to work exostoses of the bones

of the limbs are less common, while lesions and deformities of the vertebral column are more frequent, thus very often giving them the appearance of animals affected with rickets. Fatal fractures may occur at this stage from very slight causes.

(4) Stage of osteomalacia.—This is characterised by the almost complete demineralisation of the bones, which increase in size or become bent on account of the weight. The molars become loose in their alveoli and the horses may grunt on account of the thickening of the superior maxillæ. In this condition the animal can only feed with difficulty, becomes weaker and weaker and finally dies.

Animals imported at the age of three or four years show a more chronic picture, often only showing signs of chronic lameness, muscular atrophy, etc., without apparent cause.

Lesions.—In connection with the bones the lesions are first those of periostitis and ostitis at various points, and in the stage of osteoporosis, of rarefaction of the compact bony tissue, etc.

Millions of cylicostomes are always found in the caecum and colon, partly fixed to the mucous membrane and partly free. The blood always shows eosinophilia. A serous exudate is found in the peritoneal, pleural, or pericardial sacs. The intensity of the disease appears to be proportional to the parasitic infection.

The duration of the disease is difficult to determine. As regards the minimum of time, young animals imported between 20 and 24 months old may pass four to six months before showing the first symptoms and four to six months later only the more evident symptoms appear. After 10 to 15 months at Rio de Janeiro osteoporosis appears. Animals four years old or more very often develop a chronic benign form of the second or third stage, which may remain a long time unchanged.

Diagnosis.—During the first and second stages diagnosis is difficult to anyone without previous knowledge of the disease. It is, however, easy in a contaminated medium. Out of 25 racing stables in Rio de Janeiro the author knows of more than 10 infected ones. Examination of the faeces for the presence of cylicostome eggs should be resorted to.

Prognosis.—Death is generally due to fractures. During the first and second stages recovery is possible and may still be possible during the third stage, provided medullary derangements have not become pronounced. A cure is impossible in the stage of osteomalacia.

Treatment.—This consists in raising the tone and condition of the body and expelling the intestinal parasites. Balls made up according to the following formula are administered three or four times at intervals of from two to four days to two-year-olds:—

Thymol	6 grammes.
Santonin	50 centigrammes.
Cape Aloes	6 grammes.
Medicinal Soap to make	1 ball.

For three or four-year-olds the doses are increased by about a half, and if they are already infected the doses are doubled. Excellent results are claimed to follow this treatment administered during the first and second stages of the disease.

Preventive treatment.—This consists in the effective disposal of infected faeces, and the following are the two principal points which

should thus be followed.—(1) Avoid the introduction into stables or pastures free from parasites of animals infected with cyclostomes. (2) Where parasites exist try and destroy them by the use of certain vermicides, and cause them to disappear from pastures by the use of lime, sulphates, drainage, and, preferably, by ploughing and cultivation of suspected land.

[In the discussion on this memoir Van SACEGHEN stated that all the equines in Zambi, Belgian Congo, are affected with *Cyclicostomum tetracanthum* but that no case of osteoporosis has been observed there. When these equines are taken to Kitobola (Lower Congo) they there contract osteoporosis.]

(292) URBAIN (G.). *Encéphalo-myélite pseudo-épizootique du cheval.*
[Equine Pseudo-Epidemic Encephalo-Myelitis.]—*Bull. Soc. Path. Exot.* 1916. Oct Vol. 9. No. 8. pp. 557-561.

The author describes a very fatal disease of equines in Paraná (Brazil), where it is known under the name of “*Peste de Cegar*” (Blindness disease). The disease, which in the great majority of cases takes on a rapid course, is characterised by the following symptoms : (1) blindness, (2) circular movements followed by unilateral paralysis, (3) immobility, where the animal remains for hours without moving, and then (4) a stage of excitability, depression, coma, and death. The stage of excitability supervenes in about seven or eight hours after the appearance of blindness, and the animal suddenly shows symptoms of mania.

The disease differs from the so-called Borna disease, which also affects cattle and is characterised clinically by symptoms of cerebral excitability accompanied by muscular contractions and followed by paralysis. SIEDAMOGROTZKY and other authors state that the causal organism is a micrococcus affecting the nerve centres. In “*Peste de Cegar*” there is no forcible contraction of the muscles of the poll as in Borna disease ; it also appears to be specific to the horse and outbreaks commence to occur during the Brazilian winter and disappear completely in summer, whereas the Borna disease reaches its maximum intensity in summer.

On post-mortem examination the following lesions are found. The stomach is greatly dilated and filled with undigested maize in a state of fermentation. Its mucous membrane is considerably inflamed. The other organs and viscera show signs of intoxication. The most important lesions are found in the nervous system and consist in congestion of the frontal convolutions and haemorrhages into the optic lobes, the corpora striata, or into the medulla. The lateral ventricles are filled up and the nerve cells in contact with the cerebral fluid are degenerated, presenting thus at first sight the appearance of an abscess. The spinal cord shows the same lesions.

The stomach contents are found to contain an Aspergillus, on microscopic examination. No organism was found in the blood or in the nervous system. The inoculation of blood and cerebral fluid into the rabbit, rat, horse, and sheep gave negative results.

The author believes that the disease is due to an Aspergillus found in maize for the following reasons :—

(a) On post-mortem examination a large number of moulds of the aspergillus type are always found in the maize and in the stomach of

animals dead of the disease ; (b) the disease appears especially in the spring when conditions of warmth and moisture are favourable for the development of moulds in newly harvested maize ; (c) the disease is only found in animals that have eaten maize ; (d) if the maize is scorched before use no horses are lost from this disease.

DUPONT's theory that the disease is caused by a virus found in marsh water is inadmissible because the disease only attacks horses belonging to carters, and these horses are never allowed to graze in the fields and are fed almost entirely on maize bought in wayside shops ; further, when a case of the disease occurs their horses are turned into the prairies and no further cases occur.

(293) URBAIN (G.). *Méningo-encéphalo-myélite des poules (?) spirillose.* [Avian Meningo-Encephalo- Myelitis (?) Spirilliosis.]—*Bull. Soc. Path. Exot.* 1916. Oct. Vol. 9. No. 8. pp. 561-563.

This is a disease known locally under the name of "Ar," affecting adult fowls in the State of Paraná, Brazil. It is not contagious and only affects a few fowls in each poultry run. The disease lasts from 15-30 days and the symptoms shown are first, somnolence and inappetence, then conjunctivitis, followed by keratitis affecting first one and later both eyes, and then symptoms of meningitis as shown by forced contraction of the neck muscles causing the head to touch the body. The wings and feet later become paralysed and a day or two before death the animal shows epileptiform fits.

On post-mortem examination the liver, spleen, kidneys, and heart are found to be affected with degeneration ; the meninges are inflamed and a lemon-coloured fluid is found between them and the brain. Petechiae are found in various parts of the brain and spinal cord. The blood shows a marked eosinophilia.

In the conjunctival secretions, the aqueous humour of the eye, pharyngeal secretions, intestinal contents, and nervous substance a micro-organism was found in the form of a Spirillum which stains blue with Giemsa and shows two or three red stained granules. This organism was found in pure culture in the eye and brain. Negative results have so far followed attempts at transmitting the disease by inoculation of products from diseased birds into rabbits and fowls.

(294) VAN SACEGHEM (R.) *Travaux du Laboratoire de Bactériologie vétérinaire de Zambi (Bas-Congo).* [Investigations carried out at the Laboratory of Veterinary Bacteriology at Zambi, Lower Congo.]—*Bull. Agric. Congo Belge.* 1916. Mar.-June. Vol 7. No. 1-2. pp. 114-130. With 10 text-figs.

(I) EPIZOOTIC ABORTION OF ASSES AT ZAMBI, pp. 114-116.

In a previous report (1914) the author gave the opinion that epizootic abortion was a clinical identity, with specific causal organisms in each case, for bovines, equines, and ovines, respectively.

The bacillus, the cause of epizootic abortion in asses at Zambi, was found in enormous quantities in the stomach and blood of the foetus, as well as in the spleen, liver, lungs, and the foetal membranes ; the uterus and vagina of affected animals also harbour the germs.

The bacillus is very small; it is motile, but does not execute any appreciable translatory movements. On agar a growth is seen after 24 hours at 37° C.; a growth is even obtained at ordinary temperature (average 26° C.). In broth young cultures give a uniform turbidity; in old cultures flocculi are seen.

Cultures are only feebly virulent for small laboratory animals.

Clinically, the disease is manifested by abortion and between two successive abortions the animal shows no symptom. The vaginal discharge, seen after abortion, is sometimes very transient in character.

The author employed the agglutination test in order to diagnose the disease, using as emulsion a 24 hour-old broth culture of an organism isolated from a foetus. It seems that the maximum agglutination produced by the serum of chronically affected asses is given in dilutions of 1/200. The serum of an ass that had never aborted and of equines and bovines gave entirely negative results.

The disease observed at Zambi seems to be specific for the ass, of any breed or origin. Attempts at infecting horses and bovines failed completely.

The author has tentatively employed vaccination by means of cultures of the specific organism killed by heating. Injection was followed by a marked local reaction of varying intensity together with an appreciable febrile reaction. The results of this treatment are not given.

The author has been able to adopt all the necessary prophylactic measures by employing the agglutination test for diagnosing the presence of the infection among infected animals.

(II) PIG-BREEDING IN THE ZAMBI DISTRICT LOWER CONGO, pp. 116-123. With 6 figs.

The black native pig of this district is not suitable for profitable breeding owing to its degenerate nature; the average weight is about 30 kilogrammes. A priori it is, however, more advantageous to ameliorate a native breed, adapted to the environment and possessing a specific resistance against the prevailing diseases. Experiments made at Zambi have nevertheless proved that the produce obtained by crossing a pure Belgian breed with the native pig have given surprising results, in that while they inherited the resistant qualities of the native pig they showed marked increase in size and weight; three months old young pigs of 3/4 Belgian breed exceeded in weight the pure Belgian pigs.

The diseases affecting pigs in the lower Congo are numerous but fortunately have nearly all been identified and suitable methods of treatment adopted. The following is a list:—

(1) Disease of young pigs due to a bacillus of the typhoid group.

(2) *Myiases*. These are particularly prevalent in the rainy season and are produced by the larvae of a fly (*Lucilia sericata*, Meig.). Treatment consists in the application of 10% carbolic ointment to the wounds.

(3) *Parasites*. The most formidable is a chigger (*Sarcopsylla penetrans*). This makes its appearance in the dry season when the female fixes itself on to the skin; the infection is spread indirectly by means of infected piggeries, etc. The chigger may cause serious damage both on account of the sores it produces and by obstructing the teats, which

are sometimes so thickly covered that the mothers refuse to suckle their young. Treatment consists in placing the pigs at some distance from native dwellings and disinfection of piggeries, especially during the dry season. Two other kinds of parasites are also frequently found on pigs, viz., *Haematopinus*, and ticks (*Rhipicephalus appendiculatus*, *R. simus*, *R. bursa*). The only practical means of getting rid of these vermin is by systematic application of the dipping tank method.

(4) *Cysticercus cellulose*, the cause of measly pork, is common, and pigs should thus be kept away from places contaminated with the excreta of natives.

All pigs were found to be affected with *Balantidium coli*. Streptococci, spirochaetes, and infusoria which resembled the genus *Butschlia*, were found in the intestines of young pigs.

(5) The bulb of a certain plant (*Albuca variegata*, Wild) was reported to have caused considerable mortality among pigs in the Moanda district; experiments made by the author showed that injection of this plant into pigs did not produce any harmful effect.

The only species of trypanosome found in the Zambi district resembles the *T. cauzalboui*, but differs in certain details. This trypanosome is devoid of pathogenicity for the pig.

(III) A NEW BACILLUS (*B. zambiensis*), pp. 124-125.

This is a saprophyte always found on the skin of bovines, equines, and antelopes in the lower Congo. It is polymorphous, often seen in the form of short filaments, $5 \times .7\mu$. In these filaments are seen refractile bodies, about six in number, which are the sporulating forms of *B. zambiensis*. The bacillus is also seen in the form of separate rods of variable length up to 3.6μ by $.7\mu$ broad. Besides these two forms one may observe a strepto-bacillary form in which the more or less long chains are curved or interlaced.

The bacillus grows very well at ordinary temperatures on agar and Sabouraud agar, in the form of a strepto-bacillus and isolated forms. These become transformed into spores for the most part on the eleventh day. Agar cultures are thick, creamy, viscous, and dirty white in colour. Towards the seventh day the film becomes wrinkled, giving rise to elevations with serpiginous margins. The bacillus is strictly aerobic. In ox serum the bacillus grows with the same characters, giving rise to a surface film from which grows a flocculent deposit.

Transplantation on to Sabouraud medium is difficult, growth is slow and the bacilli are only found in the form of simple isolated forms. The bacillus is surrounded by a capsule.

The organism shows no pathogenicity so long as it remains on the skin. As soon as it gains access to the cellular tissues it becomes virulent.

(IV) A CUTANEOUS MYIASIS. pp. 125-127. With 1 fig.

The cutaneous myiases observed in the domesticated animals are produced by the larvae of Muscidae belonging to the sub-families Muscinae and Sarcophaginae.

The author has observed several cases of this disease in breeding stock at Zambi. All were complications of accidental wounds. One of these lesions was found on the external surface of a pig's ear, another on the posterior part of a cow's udder, and a third on the testicle of a young bull. All these sores present the same aspect; they are

3 to 4 cm. deep by about 3 cm. broad, give rise to an offensive odour and show abundant bleeding and budding. A mass of moving larvae is found inside the sores and behind the fleshy buds. The margins of the sores are perpendicular and the surrounding tissues are considerably indurated. The affected animals are considerably depressed, and show lack of appetite and wasting.

The larvae are described as being all identical, of a dirty-white colour, very active, 15 to 17 mm. long by 5 mm. broad; the head is furnished with two black sharp hooklets showing synchronous movements. A piece of meat 3 cm. long by about 2 cm. broad was completely devoured in 24 hours by 10 larvae. The cephalic end of the larvae is pointed, the posterior end of the body is broadened out. The body is divided into 12 movable segments, each segment being covered with several rows of small spines of a brighter colour and directed backwards. The author succeeded in rearing the larvae, which became transformed into pupae and then gave rise to insects of the genus *Lucilia*.

Treatment consists in the application of 10% carbolic vaseline to the sore, which becomes closed up after a few days.

(V) A CASE OF STYFZIEKTE AT PASO-KONDE, NEAR ZAMBI. pp. 127-130. With 3 figs.

This disease is well known in South Africa, where it has been described by THEILER. It has not hitherto been identified in any other parts. The animal described was reported to be lame and on examination by the author was found to be in good general condition but presented peculiar movements, viz., it walked on the heels of all four feet, taking short steps, the hoofs were hot and considerable pain was felt on pressing the shoulder. Examination of gland juice as well as of the blood proved negative. No improvement was observed in the course of many weeks. Observed afterwards at the laboratory the acute symptoms disappeared after some weeks but the deformation of the hoof became daily more and more marked. All the hoofs became longer than those of other animals. No articular lesion was noted.

In South Africa the disease has been attributed to poisoning by *Crotalaria burkeana*, but THEILER believes that other agents are capable of producing the affection as well. The affection appears to be common on pastures where there is an acid vegetation.

This case observed at Zambi differs in some respects from the majority of cases of Styfziekte, in that there was simply a lengthening of the hoofs and it apparently resembled laminitis of equines. There was no lack of phosphates in the earth of the district and no *C. burkeana* was found, but there were many very damp marshes with an acid vegetation.

TECHNIQUE.

(295) NORRIS (R. V.). A Comparison of the "Defibrination" and "Oxalate" Methods of Serum Preparation as applied to Haemorrhagic Septicaemia and Anthrax Sera together with Some Analyses of Buffalo and Hill Bull Blood.—*Bull. Agric. Res. Inst. Pusa*. No. 60. 15 pp. 1916. Calcutta: Supt. Govt. Printing.

In these notes a brief account is given of some comparative experiments carried out at the Muktesar Laboratory, India, in which the

above two different methods were examined in order to determine the influence on the yield and quantity of the serum in each case.

After immunisation each animal at present is bled three times in series at intervals of four days, the quantity of blood withdrawn each time being at the rate of 6 cc. per lb. body weight.

Defibrination method. The blood is drawn into bottles containing a coil of copper wire, is defibrinated by shaking, and the defibrinated blood then centrifuged.

Oxalate method. The blood is run into bottles containing 10 cc. of a 10 per cent. solution of potassium oxalate per litre of blood. In the case of buffaloes the corpuscles settle very quickly and a large proportion—50 per cent. of the blood—of clear plasma can be syphoned off. The residue is then centrifuged. In the case of hill bulls the whole of the blood has to be centrifuged as the corpuscles show no tendency to settle. The oxalated plasma is clotted by the addition of 10 cc. of a 12 per cent. solution of calcium chloride to each litre of plasma. The contraction of the clot is accelerated by the addition of weights.

The results of these experiments are given in the tables of which the following two represent a summary:—

TABLE XII.

Haemorrhagic Septicaemia.

Serum Yields.

Animal.	Nature of Bleeding.	Average yield of serum. Percentage of whole blood drawn.	
		Defibrination method.	Oxalate method.
	Bleedings.		
Buffaloes ..	1st	50·6	56·4
" ..	2nd	52·0	59·2
" ..	3rd	58·5	62·8
Hill Bulls ..	1st	48·3	57·1
" "	2nd	52·7	56·2
" "	3rd	—	56·4

TABLE XIX.

Anthrax.

Serum Yields.

Animal.	Nature of Bleeding.	Average yield of serum. Percentage of whole blood drawn.	
		Defibrination method.	Oxalate method.
Buffaloes ..	1st	48·6	56·6
" ..	2nd	54·3	59·4
" ..	3rd	61·7	63·7

A chemical analyses of a number of buffalo and hill bull bloods and of their various constituents was also made. The results are given in the following summary :—

"(1) In the preparation of haemorrhagic septicaemia and anthrax sera the oxalate method gives a considerably increased yield of serum as compared with the defibrination method.

"(2) The serum prepared by the oxalate method is greatly superior in appearance to that obtained by defibrination and centrifugalisation.

"(3) In the case of buffalo blood the oxalate method saves 50 per cent. of the centrifugalising as the corpuscles settle rapidly and the plasma can be syphoned off. This point is of considerable practical importance where large quantities of sera are dealt with as the consequent economy in engine power entails an appreciable saving of expense.

"(4) With hill bull blood the corpuscles show little tendency to settle and the whole of the blood has to be centrifugalised as in the defibrination method.

"(5) In both haemorrhagic septicaemia and anthrax bleedings if a series of bleedings be taken at short intervals the yield of serum increases progressively, the third bleeding giving a larger percentage of serum than the second which in turn yields more than the first.

"(6) Analyses of normal buffalo and hill bull blood show that the serum from the latter animal contains a considerably larger percentage of globulins than does that from buffaloes. This seems to be the chief point of difference between the two bloods."

(296) LANGE (C.). *Die Bedeutung der Salze für spezifische Agglutination.* [The Importance of Salts in Specific Agglutination.]—*Zeitschr. f. Immunitätsforsch.* 1916. June 8. Vol. 24. No. 6. pp. 587-620.

Summary :—

"According to the new tests employed in our researches one must, in the study of the question as to what importance salts have in specific agglutination, place in the foreground the fact that the agglutinin is not a single body, but is composed of various protein fractions of the serum that act differently also in the course of agglutination on account of their chemical and physical differences.

In order to find out how agglutination, or even only a part of it, viz., the combination of the agglutinin with the agglutinable substance, takes place in a salt-free medium one must take into consideration the fact that a part of the agglutinin (I), which is composed of euglobulins and pseudo-globulins insoluble in water, remains undissolved in the salt-free medium and consequently does not enter into the question of agglutination, a fact which earlier workers have not borne in mind.

"As regards this portion of the agglutinin the salt only plays the rôle of holding the protein substance in solution and this can be done equally well by means of a trace of soda.

The importance of the salt in the phenomenon of agglutination is not, however, here exhausted; by quantitative analysis of the occurrences it is seen that a portion of the agglutinin, belonging to the albumins, can bring about agglutination in a perfectly salt-free medium. This portion of the agglutinin (II) appears to be inconstant or at all events to be present only in very small quantities.

"In addition to this the salt appears to play a part analogous to Bordet's tonic suspensions in that the sensitized bacteria are kept more easily dispersed in the presence of a neutral salt.

"A division of the course of agglutination into two phases, viz. (1) combination of the agglutinin with the agglutinable substances, which can take place in a salt-free medium, and (2) clumping through the agency of the salt, can no longer be considered correct in the light of our experiments.

"The theory of the binding of the (whole) agglutinin to the agglutinable substance in a salt-free medium can no more be looked upon as valid according to our experiments.

"The salts thus play a different rôle for the different portions of the agglutinin; for agglutinin I. they are necessary especially to hold this portion in solution, for agglutinin II. they are altogether unimportant, and in the third instance they apparently have only the importance of an accessory physical agent which favours the clumping without being absolutely necessary for the accomplishment of the phenomenon."

(297) LESCHLY (W.). *Versuche über Komplement. I. Komplement und Ambozeptor.* [Experiments on the Complement.]—*Zeitschr. f. Immunitätsforsch.* 1916. Apr. 18. Vol. 24. No. 5. pp. 499-540.

Summary:—

"When fresh sheep blood corpuscles and fresh guinea-pig serum are employed the titer and action of the complement is within very wide limits little dependent upon the quantity of amboceptor employed, provided that the latter is sufficient to produce total haemolysis. On the contrary, the titer and action of the amboceptor is very little dependent on the quantity of complement, provided that sufficient quantity is employed to bring about total haemolysis.

"If larger quantities (more than 20 units) of amboceptor are employed, the conditions are rather different; all stronger amboceptors had even in a quantity up to 200 units only a slight influence on the action of the complement, whilst the weaker amboceptors in larger doses had an inhibitory effect on haemolysis. Out of the amboceptors tested six had a very different action in that they produced haemolysis by themselves in larger quantities, apparently because the complement in them had not been sufficiently destroyed.

"On storing, the resistance of the blood corpuscles becomes decreased, more quickly when held in a 5 per cent. suspension than when freed as far as possible from salt solution. The diminished resistance shows itself first of all by an increase in the titer of the amboceptor. Only after this has taken place is the action of the complement dependent on the quantity of amboceptor.

"The resistance of the blood corpuscles is considerably diminished by lying in contact with the amboceptor.

"On the other hand, the resistance is apparently not dependent on whether the corpuscles have been washed once or several times, or on whether they have been procured by defibrination or by the addition of citrate or oxalate solutions to the blood.

"The action of stored complement is likewise dependent on the quantity of amboceptor to a far higher degree than is the action of a fresh complement. This change in the complement is manifested whether the guinea-pig serum is stored with the mixture or separate from it, and more quickly at higher than at lower temperatures. Neither in the case of amboceptors nor in guinea-pig sera were there brought out individual peculiarities of a practical importance in the sense that Scheller indicated. On the other hand there were found differences in the degree of rapidity with which the amboceptors haemolysed and combined.

"Ox blood corpuscles showed the same characters as sheep corpuscles but the fresh corpuscles (i.e., those just procured from the slaughterhouse) sometimes showed diminished resistance.

"Also, in a haemolytic system with pig blood corpuscles, an increase in the quantity of amboceptor employed did not make it possible to diminish the quantity of complement necessary for total haemolysis.

"Contrary to the assertion of Scheller, the action of the complement, measured by the final result, is in reality decided by the absolute quantity and not by the concentration employed.

"On the other hand there exists a distinct relation between the rapidity of haemolysis and the concentration of the complement, inasmuch as the quantities of complement that haemolyse in different volumes with

the same rapidity are proportional to the volumes used in each case, i.e., the same complement concentration produced haemolysis with the same rapidity.

"As against the statements of Scheller, titer doses of complement are capable of completely haemolysing only a slightly larger quantity of blood than that for which the titer is determined. By increasing the quantity of blood, a certain quantity of complement ordinarily haemolyses absolutely larger, but relatively smaller, quantities."

REPORTS AND MEMORANDA.

(298) EGYPT. Ministry of Agriculture. Veterinary Service. Annual Report for the Year 1915. [LITTLEWOOD (W.), Director, Veterinary Service.)—pp. vi + 59. 1916. Cairo: Govt. Press. [Price P.T.5.]

This report comprises three sections dealing, respectively, with (1) Contagious Diseases, (2) The Veterinary Pathological Laboratory (MASON, F. E.), and (3) School of Veterinary Medicine (RABAGLIATI D. S.).

SECTION 1. CONTAGIOUS DISEASES.

In this section statistics are given with regard to the number of cases of the various diseases reported and their distribution in the various provinces, together with the figures for the preceding year. The figures for the year 1915 are as follows:—

Cattle plague 358 deaths, together with 110 additional cases in the Alexandria quarantine pens and abattoir amongst cattle imported from the Sudan. The number of cattle doubly inoculated, that is, with virulent blood and serum was 4,833, among which 29 deaths occurred; 104,916 were inoculated in 1914. 781 cattle that had been immunised in June and July 1912 were tested with virulent blood and none died after the operation, showing that a high degree of immunity had been conferred. The number of deaths from cattle plague was the smallest since the disease was introduced in 1903.

Rabies, 65 cases—57 dogs, 1 cat, 5 monkeys, and 2 horses. Glanders, 52 cases, as against 37 cases in 1914. Epizootic lymphangitis, 13 cases. Anthrax, 11 deaths. Sheep pox, 99 cases. Foot-and-mouth disease, nil. Haemorrhagic septicaemia, 29 cases in buffaloes and cattle; in addition 18 cases were reported for the first time in Egyptian sheep. Mange, 201 cases; about half the camels of the country are probably affected in addition. Strangles, 4 cases. Spirochaetosis in fowls, 5 cases. Trypanosomiasis, 62 cases. Filariasis, 1 case. Malta fever, nil. Piroplasmosis, 98 cases (cattle 84, horses 12, dogs 2); in addition, among the Sudanese cattle 94 cases were detected in quarantine stations and abattoirs. Tuberculosis, 1,143 cases reported, nearly all in the Cairo and Alexandria abattoirs. Tetanus, 16 cases. Ovine caseous lymphangitis, 3 cases. Cerebro-spinal meningitis, nil. Cow pox, nil. Coccidiosis, 29 cases detected in sheep, cattle, and rabbits. Equine pneumonia, nil. Contagious bovine pleuro-pneumonia, 111 cases, and in addition 1,205 cases were reported by the Sudanese Government. Stiff sickness, 215 cases. Bursati, 1 case. Ringworm, 1 horse and 1 sheep. Camel pox, 38 cases. Avian diphtheria, 170 cases.

Statistics are given dealing with the Sudan trade, which for the time being is almost the only source of cattle and sheep from abroad, the Shellal quarantine station, animals imported from other countries besides the Sudan, the isolation hospital for contagious diseases of animals at Abbassia, a census of cattle, horses, mules, donkeys, camels, sheep and goats, and animals slaughtered.

SECTION 2. VETERINARY PATHOLOGICAL LABORATORY (MASON, F. E.).

Figures are given showing the number of specimens of various diseases examined at the laboratory; a considerable amount of work was also done for the British Army in Egypt.

Investigations were carried on throughout the year into the nature of diseases affecting Sudanese animals arriving in quarantine. The following diseases were detected:—

(1) *Bilharziosis* (*Schistosomum bovis*). 65 cases were discovered and observations made are dealt with in a separate publication.

(2) *Cattle plague*.

(3) *Coccidiosis* (*Eimeria zurni*). In Sudanese cattle the majority of cases detected were sub-acute in character, the chief lesion being a patchy inflammation of the intestine, not as a rule producing a fatal termination. In Sudanese sheep coccidiosis (*Eimeria faurei*) has been found to be responsible for a higher mortality than any other disease. On several occasions circumstances have arisen necessitating keeping infected flocks for a considerable time before slaughter; in these circumstances precautions have been taken, with good results, for the repression of the disease, based upon the knowledge of the mode of its transmission and the life-history of the parasite.

(4) *Contagious bovine pleuro-pneumonia*.

(5) *Oesophagostomiasis*. Found to be of frequent occurrence both amongst Sudanese cattle (*O. inflatum*) and sheep (*O. columbianum*). In cattle the parasite does not appear to cause much danger and is often found in the apparently healthy animals. In sheep the effect is much more marked; it produces progressive emaciation and finally death from cachexia. The parasite has not hitherto been detected in Egyptian cattle, but has been found in sheep and pigs.

(6) *Onchocerciasis*. Three varieties were observed, viz.: (a) *O. fasciata*, found subcutaneously in Sudanese as well as Egyptian camels, causing subcutaneous fibrous growths but no general disturbance; (b) *O. armillata*, found to affect about 80 per cent. of Sudanese cattle, a similar proportion of adult Egyptian cattle, and a considerably smaller percentage of buffaloes. It inhabits the aorta and it produces loss of elasticity by the formation of extensive calcareous plates, wrinkling of the vessel walls, aneurism, and finally in extreme cases death from ruptured aneurism; (c) *O. gutturosa*, first found in Sudanese cattle inhabiting the cervical ligament. Not observed to produce effects harmful to the host. Also observed in Egyptian cattle.

(7) *Piroplasmosis*. (*Theileria parva* and *P. mutans*).

(8) *Tuberculosis*. Appears to be quite rare in Sudanese cattle.

(9) *Trypanosomiasis* (*T. pecorum*).

(10) A small *hydatid* was found to be quite common in the livers of Sudanese cattle, closely resembling structurally the *Cysticercus bovis*,

except that the outer membrane appeared to be a little thicker. The usual seats of *C. bovis* were, however, quite free.

(11) *Gangrenous oedema* was found several times in Sudanese cattle affecting the muscular masses. The lesion bore some resemblance to blackquarter. The exudate from the lesion was found to contain in almost pure culture a small bacillus with special characters. It showed a bi-polar method of staining and was easily cultivated by anaerobic methods; the disease was transmissible both by wound inoculation of exudate and of artificial culture. Natural infection frequently takes place in wounds produced by cattle horning each other.

Observations on diseases of Egyptian live stock—

(1) *Contagious pneumo-enteritis* or *haemorrhagic septicaemia* of sheep was first discovered causing considerable mortality among sheep belonging to the Ministry of Waqfs. The causal organism (*B. bi-polaris ovisepticus*) was isolated from the bodies of diseased sheep in pure culture and the disease was reproduced in experimental sheep by inoculation of this organism. The disease was observed in its three forms: acute, sub-acute, and chronic. The acute form was found most frequently to affect lambs and the other forms were found in adult sheep.

(2) *Camel pox.* Variola among camels in Egypt was first observed by MASON (H.) (March 1915) in an outbreak affecting Egyptian transport camels in which 30 cases soon occurred. Subsequently several outbreaks were observed in upper and lower Egypt occurring for the most part in adult animals. The lesions are quite typical of a variola and pass through the usual stages in about three weeks. They are found on the lips, the sheath, inside the thighs, on the belly, and inside the arms. Usually the disease takes a mild form with discrete lesions in these parts and there is very little constitutional disturbance. In more severe cases the lesions become confluent and there is a marked tendency to secondary mixed bacterial invasion producing oedematous swelling of the head and sometimes of the belly, and the odour becomes offensive; conjunctivitis and ulceration of the cornea are not uncommon. Experiments were made to ascertain the relation between the camel virus and *Variola vaccinia*. Glycerinated lymph made in the ordinary way from camel pox was found to be non-infective to calves and buffalo calves, and calf lymph was found to be non-infective to camels. The susceptibility of the experimental animals, each to his own variola, was subsequently established.

(3) Tests applied to cattle immunised against *cattle plague* by double inoculation. This has been briefly referred to in Section 1.

(4) *Spirochaetosis of domestic birds.* Has long been known to affect fowls in Egypt and more recently ducks; the transmitting agent is *Argas persicus*. During the year spirochaetosis has been observed in donkeys and in geese; the transmitting tick is of the same species as in the case of the fowl disease. Treatment with organic salts of arsenic has given good results.

(5) *Sarcosporidiosis.* Sarcosporidia have already been reported in the following domestic species, viz., buffalo, ox, sheep, goat, camel (new species), and pig. During the year sarcocysts were observed in the horse, corresponding to *S. bertrami*. Sarcospores were found free in the peripheral blood of cattle in two cases where anthrax had been suspected; death was attributed to sarcocystine poisoning.

Four buffaloes that had died showing symptoms of asphyxia showed on autopsy inflammatory oedema of the larynx, fauces, and base of the tongue. All the muscular tissue in this region was crammed with the large sarcocysts formerly known as *Balbiana gigantea*, which, in Egypt, is extremely common in buffaloes, rarely found in cattle, and has not been found in other animals.

On examination, *S. camelii* was found to be as common in imported Indian camels as it is in Egyptian and Sudanese camels.

(6) *Bursati*. Some observations on this disease are made the subject of a separate publication.

(7) *Onchocerciasis*. In addition to the species mentioned above *O. reticulata* was found in the aortic wall of an Arab horse which showed a well-developed fusiform aneurism. *O. gibsoni* is stated not to exist at present in either buffalo or cattle in Egypt.

(8) "Tropical ulcer" in equines. This attacks imported equines in the neighbourhood of Abbassia every summer. The lesion, which may be single or multiple, takes the form of a rapidly forming ulcer about 1 to 3 inches in diameter. It is frequently observed on the skin towards the inner canthus of the eye and also on the lips; other parts are also often attacked. The disease is apparently due to wound inoculation as the smallest abrasion during an outbreak is likely to become infected and develop the typical ulcer. It is first seen under or in the skin as a small hard swelling which causes some irritation; it rapidly increases in size and about the third day the ulcer is formed with a hard base. There is no systematic disturbance.

Smears from the depth of the indurated tissue showed the presence of bi-polar organisms. The disease was reproduced by subcutaneous inoculation of cultures of these organisms. The ulcers are very resistant to ordinary drug treatment and surgical excision only spreads the infection to the wound area. Vaccine treatment gave negative results. The natural attack produces no immunity. No fungi or filaria were found in the lesions.

(9) *Pneumomycosis in horses*. Three cases were observed during the year caused by a fungus resembling *Aspergillus fumigatus*.

(10) The following ticks were identified by the Government Entomologist (Dr. GOUGH). *Margaropus annulatus*.—Repeatedly found on cattle with Texas fever and Egyptian fever. *Rhipicephalus evertsi*.—Found on cattle with Texas fever, on donkeys with malaria. *Hyalomma egyptium*.—Found on cattle with Texas fever, on horses with equine malaria, and on healthy animals, also on cattle with Egyptian fever. *Rhipicephalus sanguineus* and *Haemaphalis leachi*.—Found on dogs with malaria. *Argas persicus*.—Found associated with spirochaetosis in fowls, geese, turkeys, and ducks. *Boophilus australis*.—Found on cattle with Texas fever and during an outbreak of Egyptian fever. *Rhipicephalus oculatus*.—On healthy camels.

(11) *A new form of piroplasmosis in Egyptian sheep*. In the author's report for 1914 he described the discovery of an entirely new form of piroplasmosis in Sudanese sheep, of which the essential feature was that the causal organism was a *Theileria* and not a *Babesia*. During the year it was found that a similar disease is of common occurrence in Egyptian sheep. The causal organism, seen in the red blood corpuscles, closely resembles the corresponding element in East Coast Fever, but is even more minute. Schizonts (Koch's blue bodies) are found in the

spleen, glands, and infarcts. The spleen is enlarged to three or four times its normal weight, the kidneys contain white infarcts, the stomach shows linear congestion and the intestines some degree of patchy inflammation.

Note on spraying of cattle with special dips for the eradication of ticks
(COOPER H.).

The Ministry of Agriculture decided to test the efficacy of spraying with a specially prepared arsenical dip. Cattle were sprayed all over with one part of dip to 150 parts of water at intervals of from 6 to 10 days, care being taken to treat every part of the skin including the inside of the ears. It was found advisable to spray at least five times, the cattle being allowed to return to the stable during the intervals. Old cattle sheds were destroyed to prevent their harbouring the ticks.

It was found that even in cases of very bad original infection no ticks could be detected on the skins of cattle 16 days after the fourth spraying. Three or four days elapse after spraying before the larger ticks die. Nile water was found to be preferable to well water as the latter seemed to coagulate the dip and the pumps got out of order.

A census of cattle, buffaloes, sheep, goats, camels, pigs, horses, mules, donkeys, and of animals slaughtered in abattoirs, is appended.

(299) UNITED PROVINCES. Annual Report of the Civil Veterinary Department, for the Year ending March 31st 1916. [OLIVER (E.W.).] —*Vet. Record.* 1916. Nov. 4th, 11th, and 18th. Nos. 1478, 1479, and 1480. pp. 187-189, 202-204, and 210.

The greater part of this report deals with administrative work, including the composition of the subordinate establishment, veterinary instruction, veterinary hospitals and dispensaries, and breeding operations. 145 stud bulls and buffaloes are maintained in 38 districts for use on loan under the control of the Civil Veterinary Department. Two cattle farms are maintained by the Department. 63 horse and pony stallions are maintained, and also 20 donkey stallions. Attention is also paid to sheep breeding.

Treatment of Disease. Equine. Only a few cases of surra occurred during the year, the decrease being due, it is believed, to the unusual scarcity of certain blood-sucking flies which generally make their appearance at the period of the year known as the surra season. Cases of horse pox, piroplasmosis, rabies and other diseases were met with but no returns were obtainable for these diseases.

Bovine. Considerable abatement in the ravages of rinderpest was reported during the year and very few districts were seriously affected. Whenever the disease appeared inoculation campaigns were organised, with the result that only 3,767 deaths were recorded as against 19,839 last year.

Haemorrhagic septicaemia appeared in 36 districts and 1,593 cattle were said to have succumbed, as against 1,765 last year; 254 cattle were immunised by the vaccination method and 3,841 were inoculated, both with generally satisfactory results.

There has been a satisfactory decline in the prevalence of black-quarter. Foot-and-mouth diseases affected the province less severely

than usual. The reported losses were 1,448, the mortality being chiefly confined to young stock or old weakly and decrepit animals. Anthrax was reported in 25 districts and 738 animals died. 128 head of cattle were reported as having died from other contagious diseases, including pleuro-pneumonia, etc.

Other animals. Widespread respiratory disease among goats and sheep was met with in several districts during the year. The Banda district alone reported a mortality of over 1,000. Rabies, fowl cholera, and various parasitic diseases were responsible for deaths among the smaller domesticated animals.

Preventive inoculation. 225 outbreaks of disease and 18,661 animals were treated by this method as compared with 78,194 of last year, the enormous decrease being due to the very limited prevalence of disease in the province as reported above.

Investigation of disease. Investigations were conducted in connection with kamri, pleuro-pneumonia in sheep and goats, gillar bursati, akrah, fowl cholera, piroplasmosis, etc.

(300) FEDERATED MALAY STATES. Medical Report for the Year 1914.
[SANSOM (C. L.).] (Reprinted from *Jl. Trop. Med. & Hyg.*
[Colonial Medical Reports]. 1916. Oct. 2. Vol. 19. No. 19. p. 76).

VETERINARY.—“An outbreak of rinderpest occurred in May, at 26th mile, Kuala Selangor-Klang Road. There were 54 cases with 30 deaths.

“Selangor.—With the exception of January, September, and October, foot-and-mouth disease prevailed all over the State during the year. There was a total of 3,906 cases with 86 deaths. The disease was as usual of the ordinary mild type.

“Perak.—Three hundred and thirty-one cases were reported from this State; five died and 209 were destroyed.

“Negri Sembilan.—One thousand nine hundred and sixty-nine cases of a mild type occurred amongst cattle in Negri Sembilan with 28 deaths.

“There were two separate outbreaks in Ulu Pahang. 1,188 cases were detected with 20 deaths.

“There were five cases of surra in Perak, one in Selangor, twenty in Negri Sembilan, and fourteen in Pahang.

“Three hundred and forty-five cases of swine fever with 226 deaths were recorded in Selangor. A severe outbreak was found at Batang Malaka and Gemencheh (N.S.) during August. These places are situated near the Malacca boundary, and the disease was introduced from Malacca. Four hundred and fifty cases with 300 deaths were reported to have occurred before the outbreak was discovered, and a number of people had to be prosecuted for not reporting the disease. Fifty-seven cases with 38 deaths occurred subsequently, and at the end of the year the disease had been stamped out. Swine fever also broke out in the Seremban district during September, but was confined to certain areas, 271 cases occurring with 193 deaths, the majority of deaths being amongst young pigs.

“An outbreak of pleuro-pneumonia amongst goats occurred in a herd brought from Kedah or Siam to Lenggong in October. Out of 34 goats, 30 died; 12 cases were also reported at Grit.

“QUARANTINE STATIONS.—Two thousand six hundred and ninety-seven cattle were imported into Perak North via Port Weld, Parit Buntar, Selama, and Upper Perak, as against 4,433 in 1913.

“Two hundred and sixty-seven head of Government cattle were treated during the year by the Veterinary Department.

“*Port Swettenham.*—Four thousand five hundred and eighty-four cattle were quarantined at this Station. There were 23 deaths.

“*Bukit Sentul.*—Two hundred and forty-three cattle were quarantined and 289 released during the year, including 51 left over from 1913; five deaths occurred and 103 cases of foot-and-mouth disease were treated.

"*Kuala Kubu*.—Seventy-seven cattle were quarantined. There were 53 cases of foot-and-mouth disease, all of which recovered.

"*Negri Sembilan*.—The quarantine stations at Tampin and Port Dickson were completed during the year.

"*Pahang*.—The station at Teluk Sisek is now ready for reception of animals arriving at Kuantan by sea.

"The ground for the Raub quarantine station has been selected, but nothing further has been done.

"In dealing with all these outbreaks the Veterinary Department has shown energy and promptitude, and thus saved greater loss of life amongst cattle. The management of cattle quarantine stations has also been very satisfactory.

"During the year there were 1,346 police-court cases, resulting in 1,254 convictions, and fines amounting to \$11,830 were imposed."

(301) MONTGOMERY (R. E.). A Memorandum on Veterinary Research as applied to the East Africa Protectorate. 16 pp. f'cap. 1916
July 14. MS. Report received in Colonial Office.

The object of this report is to state a case for obtaining adequate funds for the erection and equipment with personnel and materiel of a laboratory for veterinary research in the East Africa Protectorate.

An outline of the work done under present conditions since the author's appointment as Veterinary Bacteriologist in 1909 is first given. A good many of his investigations have been published at various times in veterinary journals. The author has evidently opened up entirely new ground by investigating the diseases of the domesticated animals in East Africa. A good many diseases peculiar to the country are enumerated while differences in the characteristics of other well-known diseases have been established. A considerable amount of work in the preparation of sera, especially anti-rinderpest serum, and of vaccines has also been done. The work represents a very creditable performance considering the facilities for research, though the material furnished must obviously have been enormous.

The principal lines are then enumerated upon which it is proposed to undertake research in connection with the following diseases:—Anaplasmosis and redwater, anthrax, blackquarter, colon bacillosis, contagious abortion, East Coast fever, horse sickness, Kikuyu fowl disease, epizootic and ulcerative lymphangitis, n'garuti, poisonous plants, rinderpest, swine fever, streptothricosis, tick-borne gastro-enteritis in sheep, trypanosomiasis, worm affections, and other unidentified conditions. This represents an ambitious programme and it would certainly afford excellent material for a number of enthusiastic investigators to work on.

It is also proposed to undertake routine diagnoses of specimens submitted, performance of biological tests for various diseases, and also the preparation of diagnostic agents, vaccines and anti-sera.

The author quotes the estimated value of live stock, which exceeded £4,000,000, for the year 1914, and also the climatic, grazing, and water facilities which the country affords to the breeder. An estimated capital outlay of £18,150 spread over two years, together with a yearly recurrent outlay of £17,760, is submitted as the amount necessary for the erection and maintenance of a laboratory where the above-mentioned research work could be prosecuted.

It is mentioned that over £50,000 per annum is spent by the Government of the Union of South Africa on veterinary research so as to make

"a bid to be regarded as a stock country." The benefits that would accrue from a proportionate expenditure on research in East Africa are claimed to be very much greater.

The trained staff would comprise one veterinary bacteriologist, three senior research officers, and four junior research officers. These would apparently include a helminthologist, an entomologist, and a chemist.

Montgomery's proposals are unhesitatingly acquiesed in by the Governor of British East Africa, but it is regretted that "at the present time, however, our financial position precludes any undertaking of the nature recommended."

- (302) HOOPER SHARPE (G. C.). *Rinderpest Observation in German East Africa*.—Report to Chief Veterinary Surgeon, Salisbury, Southern Rhodesia, from Neu Langenburg. Dated July 25. 1916. 1 p. fcap. MS. Report received in Colonial Office.

"No further news of rinderpest has been received in this country, and the position remains unchanged. It is to be hoped that with the advance of our troops towards Iringa definite news of the progress of the disease will be obtained at an early date.

"Every precaution is being taken that cattle do not enter Northern Rhodesia from this territory.

"There is a disease in this district which at present I am unable definitely to diagnose, but I think it is East Coast Fever in the endemic form; it does not affect the adult local cattle, but 50 to 60% of the calves bred in the district succumb to it. I have made a few post-mortems on calves and although I have only found infarcts in one animal I consider they are dying from a form of East Coast Fever, especially as other post-mortem symptoms are present. Amongst the adult cattle it is only those moved from other districts to this district that die. The symptoms among these are very puzzling; in one instance only have I been able to find an infarct and that doubtful, but I have always observed enlarged glands, petechial markings on heart, fluid in heart sac, and inflammation of the fourth stomach. . . ."

BOOK REVIEW.

- (303) HERMS (William B.). *Medical and Veterinary Entomology*. A Textbook for Use in Schools and Colleges as well as a Handbook for the Use of Physicians, Veterinarians and Public Health Officials.—xii + 393 pp. 8vo. With 228 figs. 1915. New York: The Macmillan Co. [Price 17s. net.]

The aim and scope of this book are indicated by the following extract from the author's preface:—"This book is not intended to be a comprehensive treatise, touching all the investigations in the field of Medical Entomology, but rather an attempt to systematise and to assist in securing for it a place among the applied biological sciences. However, a discussion is included of all the more important diseases and irritations of man and of the domesticated animals in which insects and arachnids are concerned, either as carriers or as causative organisms."

In accordance with the author's aims the book is essentially a practical one; morphological details are briefly discussed while the life-history and the disease producing activities of the various insects, together with the appropriate means of keeping them under control, are dealt with forcibly and at considerable length. Accordingly, a very considerable proportion of the book is devoted to a study of such insects as mosquitoes and the common house fly, which are of no great direct importance from a veterinary point of view,

However, as might be expected from an author who had held the post of Professor of Parasitology at a Veterinary School, a consideration of the subject from the purely veterinary aspect has been by no means neglected. Besides the introductory chapters dealing with parasites and parasitism and the broad outlines of insect anatomy and classification, the veterinary surgeon will find the chapters dealing with the blood-sucking muscids, myasis, ticks, and mites, comprising about a third of the book, of especial interest. Nearly all the conditions determined by insects in all parts of the world, together with brief descriptions of the insects, are given.

It might be complained that the descriptions of some veterinary insect diseases are rather sketchy and also that the parasites dealt with are more especially those prevailing in America rather than in England and the Colonies.

As examples of these contentions the amount of space devoted to scab and mange is comparatively small. In the case of the sheep scab parasite it is stated that "there is considerable variation in the length of time elapsing from egg to egg, 12 or 14 days is ordinarily accepted as an average"; the author could not have had in mind the recent experiments of STOCKMAN and SHILSTON on this important subject, the latter of whom showed that the period might be as low as nine days.

In the case of bovine tick-transmitting diseases it is stated that the cause of redwater is the *Babesia (Piroplasma) bigeminum* Smith and Kilborne; it is not apparently understood that *P. divergens*, at least in European cattle, is a common causal organism. The only other tick carriers of this protozoon besides the *Margaropus annulatus* Say, or *Boophilus bovis* Reilly, are stated to be the *Boophilus australis* Fuller, and *B. decoloratus* Koch; no mention is made, for example, of the common English transmitting tick, the *Ixodes ricinus*.

The book is well provided with illustrations, for the most part clear and instructive, as in the case of the diagrams illustrating the general structure of the various insects. Some, however, such as fig. 140 (*T. gambiense* in blood smear) might as well be omitted. None of the figures of the Acarini show the suckers, parts which veterinary surgeons, at least in this country, consider of great importance for diagnosis.

The book on the whole, however, must be considered as the best production on the subject that has yet appeared in the English language from the standpoint of the veterinary practitioner or student. It has already elicited highly favourable comments from such high authorities as Colonel A. ALCOCK [see *Trop. Dis. Bull.*, 1916, Oct. 30th, Vol. 8, No. 6, pp. 400-401]. The latter's concluding sentences are here reproduced as follows:—

"Taking the work as a whole, although it does not profess to be a comprehensive treatise, and although so far as its purely entomological framework goes it has some geographical limitations which perhaps carry it short of *all* the requirements of medical men whose interests lie outside the zoological regions of the New World, yet in respect of all general principles and particularly of those that underlie prevention and control, it will be found universally useful."

J. T. E.

RECENT LITERATURE.

[Continued from this *Bulletin*, Vol. 4, No. 3, pp. 141-144.]

PROTOZOA.

- (304) CHATTON (E.) & BLANC (G.). Un pseudoparasite *Cryptoplasma rhipicephali* Chatton et Blanc.—*C.R. Soc. Biol.*, 1916. May 20. Vol. 79. No. 10, pp. 402-405.
- (305) DANIELS (C. W.). Eye Lesions as a Point of Importance in directing Suspicion to Possible Trypanosome Infections.—*Ophthalmoscope*, 1915. Vol. 13. pp. 595-597.
- (306) FINZI (G.) & CAMPOS (A.). Anaplasmosi. Sul significato dei "Corpi endoglobulari"—"Punti marginali"—"Anaplasmi" trovati nel sangue degli ovini della Sardegna e del Piemonti. [Anaplasmosis. The Significance of "Intracorpulsular Bodies"—"Marginal points"—"Anaplasms" found in the Blood of Sheep in Sardinia and Piedmont.]—*Nuovo Ercolani*, 1916. Oct. 31-Nov. 10. Vol. 21. No. 30-31, pp. 494-500 (to be continued).
- (307) IGARAVÍDEZ (P. G.). Demostracion del piroplasma bigeminum en Puerto Rico. Nota preliminar. [Discovery of *P. bigeminum* in Porto Rico.]—*Bol. Asoc. Med. de Puerto Rico*, 1916. Sept. Vol. 13. No. 112, p. 181.
- (308) JOB (E.) & HIRTMANN (L.). Le cycle évolutif de l'Amibe dysenterique. [The Life-Cycle of the Dysenteric Amoeba.]—*C.R. Soc. Biol.*, 1916. May 20. Vol. 79. No. 10, pp. 421-424. With 8 text-figs.
- (309) KUEBITZ (H.). Ein Fall von Pferde-Piroplasmose in Bulgarien. [A Case of Equine Piroplasmosis in Bulgaria.]—*Arch. f. Schiffs-u. Trop.-Hyg.*, 1916. July. Vol. 20. No. 14, pp. 336-337. With 1 chart.
- (310) LÉGER (L.) & HESSE (E.). *Mrazekia*, genre nouveau de microsporidies à spores tubuleuses. [*Mrazekia*, a New Genus of Microsporidia with Tubular Spores.]—*C.R. Soc. Biol.*, 1916. May. Vol. 79. No. 9, pp. 345-348. With 1 text-fig. & 1 plate.
- (311) METALNIKOV (S.). Sur la digestion intracellulaire chez les protozoaires (La circulation des vacuoles digestives). [Intracellular Digestion in Protozoa.]—*Ann. Inst. Pasteur*, 1916. Sept. Vol. 30. No. 9, pp. 427-445. With 2 coloured plates.
- (312) MITZMAIN (M. B.). I. Collected Studies on the Insect Transmission of *Trypanosoma Evansi*. II. Summary of Experiments in the Transmission of Anthrax by Biting-Flies.—*Treasury Department, U.S. Public Health Service, Hyg. Lab. Bull.*, 1914. No. 94, 48 pp. With 5 plates.
- (313) SHAW-MACKENZIE (J. A.). The Action of Copper Salts on Protozoa.—*Med. Press & Circ.*, 1916. July 19. Vol. 102. No. 4028, pp. 50-52.

PARASITOLOGY.

i. Helminths.

- (314) GONZALEZ. Le traitement de la distomatose hépatique par l'extrait éthétré de fougère mâle. [Treatment of Hepatic Distomatosis by means of Ethereal Extract of Male Fern.]—*Rec. Méd. Vét.*, 1916. Aug. 15–Sept. 15. Vol. 92. Nos. 15 & 16, pp. 515–516. (Extracted from *Revista Veterinaria de l'España*, 1916. Apr.)
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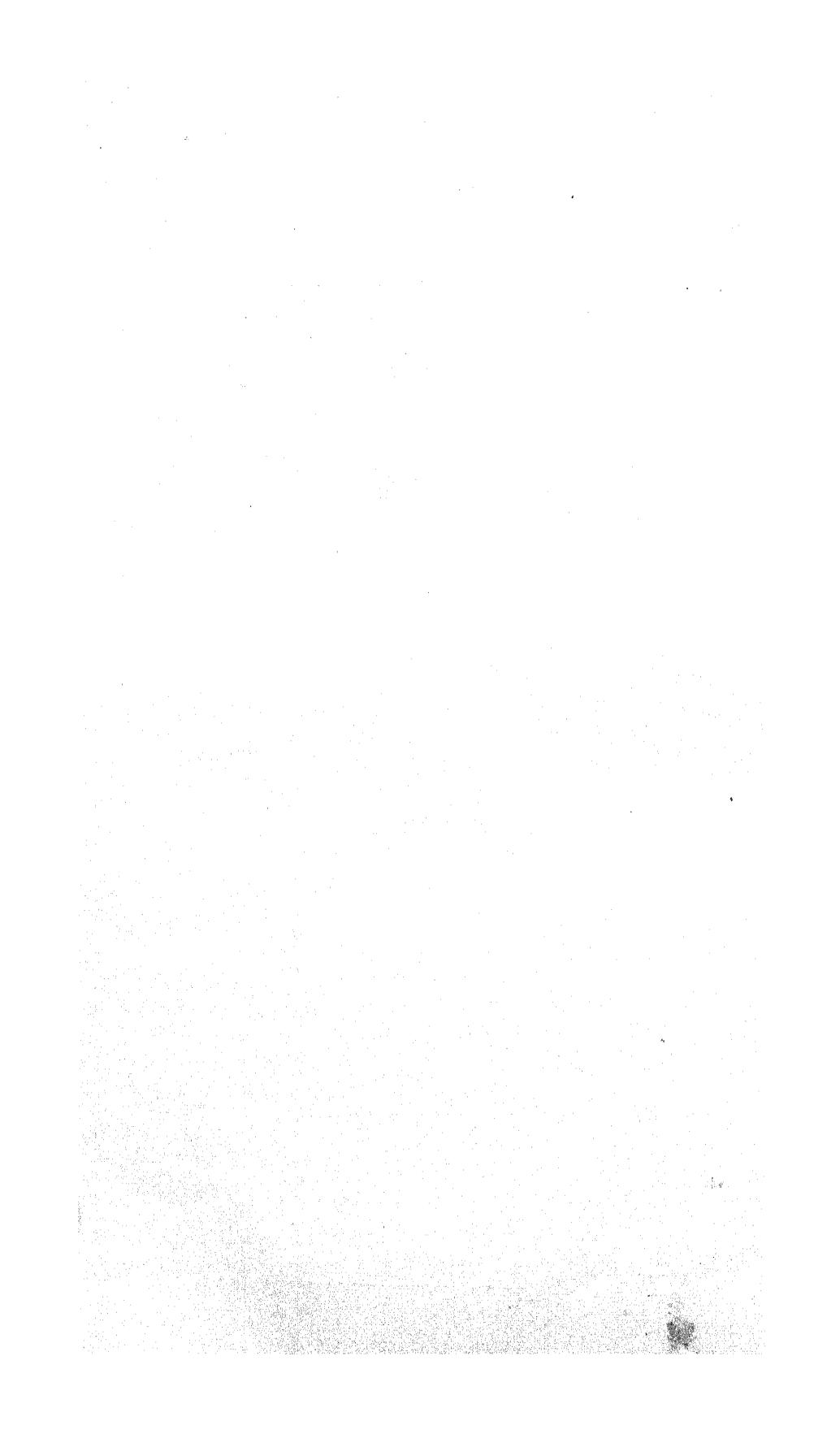
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